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Exports at Low Mark.

The foreign trade of the country has necessarily been in sympathetic relationship with the domestic trade as to bulk and value; and now that the signs are multiplying as to improved conditions in internal commerce, it is to be hoped and expected that exports will soon increase. The decline has been steady since the booming period of 1906-7, but it is not unreasonable to look for a large outflow of American electrical goods in the near future, unless new elements intervene to check the demand. During February the exports of electrical instruments, etc., were valued at $462,856 as compared with $479,779 in 1908; while for the eight months the total was only $3,768,831 as compared with $4,837,402 in 1908 and $5,714,192 in 1907. There is quite a sharp drop here, but it occurs very largely in shipments to the United Kingdom, whose trade depression has been so prolonged like our own. In 1907 England took electrical instruments and appliances to the extent of $1,237,363 in the eight months, while in the recent corresponding period the amount was only $400,469. Turning to heavy electrical machinery, another marked decline is seen. The exports this February were only $508,736 as compared with $844,047 a year ago. Here the falling off in orders is due to Mexico during the eight months, with a sharp drop for the month. During the eight months 1908-9, the grand total was $4,233,597, but last year it was $6,109,412. In like manner the demand from Mexico dropped from $1,000,977 to only $430,072 and Japan gave equal evidence of lessened consumptive capacity by taking only $641,920 instead of $1,040,917. Here is pretty well a million of the entire loss for reasons we can all very readily understand.

But international trade is not dead. Its springs are not choked up permanently. Population is increasing, civilization is spreading, and the electrical arts and applications are expanding rapidly. An evidence of the opportunities in foreign markets is afforded this week by the working agreement effected between a group of great German capitalists and industrial corporations headed by the Deutsche Bank and the syndicate heads of the French Société Générale and the French Imperial Ottoman Bank for the development of important undertakings in Turkey and the Near East, a region now in a receptive mood as to modern improvements. This syndicate is to devote its attention to the creation and building up of electric street railways, electric lighting plants and telephone systems, and is at once proceeding about its business. Now a good deal of the money thus expended will go into the purchase of German and French apparatus, but such instances may be appropriately cited as showing how the area to be supplied is all the time extending. American capital will long be needed for home development, but the American manufacturer is none the less having new markets constantly provided for him all over the world by such foreign enterprise as this. The influx of English and German capital into Mexico, for example, has been distinctly a benefit to the United States in the past, and will prove so again.

The Inductance of a Straight Wire.

In the transmission of power over wires, as in wire-telegraphy, wire-telephony, electric lighting and electric power-transmission, the inductance of a straight wire, considered by itself, is ordinarily a meaningless term. The inductance of the conductor is referred to its associated return conductor, which is either another wire or the earth itself. But in wireless telegraphy and telephony the inductance of a straight wire has a recognizable meaning. The inductance is referred partly to another portion of the same wire and partly to free space. A curve sheet for obtaining the inductance of a short straight wire in a dumb-bell oscillator is given by Mr. G. E. Marsh on page 865 of this number. The linear inductance is a simple function of the ratio of length to diameter of the straight wire. The formula and curves given in the article are fairly reliable for determining the inductance of rod-sphere dumb-bell oscillators; but they are only roughly applicable to long straight wires forming part of a complete metallic circuit even when the distance between the going and return conductors is very great. In such a case, strictly speaking, the length l in the formula takes another meaning and the formula is not reliable. It is advisable to restrict its application to the particular case in wireless telegraphy where it has been found to apply.

Ratio of Connected Load to Maximum Demand.

For a number of years it has been the practice of a considerable proportion of the larger central-station companies to make residence rates according to a system, in which a high rate per kw-hour is charged for a certain number of hours' use per month of the consumer's assumed maximum demand, all energy in excess of this amount being billed at a much lower kw-hour rate. In most cases the maximum demand of residence consumers has been assumed to be a certain percentage of the connected load. A few of the largest companies have installed maximum-demand meters at each consumer's premises, in order to determine actually from month to month what the real maximum demand is. While all have admitted that the installation of maximum-demand meters is in principle the correct method, few companies have felt that they could add to the investment per consumer an amount equal to the cost of the maximum-demand meter, because it is well known that the interest and depreciation on meters and lines necessary to serve small consumers form a large proportion of the total service cost.

The figures presented elsewhere in this issue, which are compiled from the maximum-demand meter readings of thousands of residence consumers of the Commonwealth Edison Company, of Chicago, are of the greatest value to all central-station companies which are now arbitrarily assuming the maximum demand of residence consumers as a certain percentage of the connected load. Heretofore such figures showing the ratio of maximum demand to connected load and based on actual practice from a large number of consumers have been lacking. It is also interesting to note that the Chicago company is about to take advantage of the option given it in its recent rate ordinance, permitting the removal of the maximum-demand meters from residence consumers of less than 1 kw connected load, and to assume the maximum demand as a certain percentage of the connected load. The figures from these records show that the actual maximum demand of small connected loads is larger than that of larger loads.

The Calibration of a Ballistic Galvanometer.

In the days before the advent of the ubiquitous trolley-car and electric railroad, there were numerous Thomson reflecting galvanometers with fixed coils and suspended needle-systems. These instruments have nearly all passed away, and the rising generation knows them not. Many are lost in dust and oblivion, or have fled to a better world in which there are no trolley cars. A few peacefully repose on museum shelves, as evidences of past magnetically unperturbed conditions. In those days, ballistic galvanometers carried massive, slowly moving suspended needle systems. The e.m.f. induced in the coils by the swing of the needles was comparatively small, but it was nevertheless quite appreciable; and when the capacity of a condenser was measured by observed discharge deflection, or when magnetic flux in a search coil was measured by observed ballistic deflection, a correction had to be applied for the e.m.f. induced in the galvanometer by the needle's swing, which virtually increased the resistance of the galvanometer when a shunt was applied to the same. A paper on the magnitude and observation of this correction was read in 1873 by Mr. Latimer Clark before what is now the Institution of Electrical Engineers in Great Britain. Nowadays, ballistic galvanometers are nearly always D'Arsonval instruments, with fixed magnets and suspended coils. Their magnetic power is relatively considerable, so that the e.m.f. which they induce in the coil by the swing of the same is far from negligible. If condensers are compared by discharge deflections without any shunt on the galvanometer, the correction for self-induced e.m.f. is ordinarily negligible; but when either a shunt is used or the galvanometer circuit is closed through a search-coil, the galvanometer behaves as though it had a virtually increased resistance. The correction is sometimes ignored, but the error involved may be large.

The subject is discussed by Prof. C. M. Jansky in an article printed elsewhere. He shows that the extra resistance that must be injected into the circuit in order to halve the deflection is the virtual resistance of the circuit including the extra resistance of induced e.m.f. Since, however, there is always a little uncertainty in reducing a swing to one half, owing to scale-error, damping error, and other small disturbances it is still better to double the impressed e.m.f. by doubling the number of turns in the search coil and finding the extra resistance necessary to reproduce the original deflection. This is the same test as Professor Jansky describes, except that instead of keeping the same e.m.f. and finding the extra resistance for half deflection, we double the e.m.f. and find the extra resistance for the same deflection. If the additional number of turns in the search coil introduces appreciable extra resistance into the discharge circuit, independent correction should be made for this effect.

The Radiation of Incandescent Lamps.

A recent and important paper by Coblentz in the last number of the *Bulletin* of the Bureau of Standards gives a better view of the nature of the radiation in modern incandescent lamps than anything previously published. As our readers well know, the efficiency of a lamp filament, or for that matter any other light-giving body, depends on the proportion of the total energy radiated which lies within the useful limits of the visible spectrum. We say the useful limits, since it is evident that for purposes of ordinary seeing deep-red or deep-blue radia-

tion is comparatively useless since its effect on the eye is nearly negligible compared with that of the light in the visible bright parts of the spectrum. Hence in incandescent lamps it would be of great value to obtain a filament material which will give out when heated an abnormal proportion of radiation in the bright part of the spectrum. But most solid bodies do not give noticeably selective radiation at any temperature, and the best that can be done with them is to push the temperature so high as to extend the radiation, at low temperatures invisible, as much as possible into the visible region. For such non-selective substances, the so-called "black bodies," there is a definite relation between the wave length of the radiation of maximum intensity and the working temperature; and unfortunately the temperature required to push along this maximum far enough toward the visible spectrum to give high efficiency is quite beyond the endurance of the filament material.

Hence the prospect of high efficiency lies in the direction of selective radiation. This is, of course, most highly conspicuous in incandescent gases or vapors which give line or banded spectra, whence the enormous light-giving efficiency of the flaming arc. But so far as incandescent solids are concerned, the spectra are in general continuous without marked peculiarities of any kind. A few rare oxides, however, do show bands of conspicuous selective radiation and have been utilized in the Welsbach mantle and the Nernst glower. When the new high-efficiency incandescent lamps began to appear, the question of selective radiation again came to the front. Platinum was already suspected of a certain amount of selective action, and although the new filaments were undoubtedly worked at considerably higher temperature than the older ones, there was good reason to think that selectivity also played a part in the improvement—just how much being in doubt on account of considerable uncertainty as to the real temperature of operation. The measurement of temperatures near those of high incandescence is of extremely dubious accuracy. Consequently, while many claims of selective radiation have been made, they have rested on rather uncertain foundations. In the present research Coblentz addressed himself to the investigation of this selectivity and has added very greatly to our knowledge of the subject, with due credit to previous investigators. And one of the most beautiful features of the work is that it is a complete and convincing example of the application of highly theoretical reasoning based on abtruse phenomena of theoretical physics, to the most important practical conclusions. The data are of just the sort that the so-called "practical" man likes to poke fun at, and the enthusiasts on "technical education" too often look upon with ill-disguised contempt. The connection between researches on the reflecting power of gold and silver for ultra-violet light, or on the index or refraction of fluorite, and the cause of the high efficiency in tungsten lamps is, we grant, not altogether obvious, although in fact important.

The practical question to be answered was whether metallic filaments must be driven to an enormously high temperature with consequent impairment of life in order to reach high efficiency, or whether one may reasonably expect to find material which gives radiation sufficiently selective to ensure good efficiency at practicable temperature. Now, in comparing the spectra given by various incandescent filaments, it is fairly evident immediately that there is no marked selective radiation such as is given by a flaming arc or even by a Welsbach mantle. The spectra are quite continuous and save for temperature variations, remarkably similar, as indeed the similarity of color shows. Within the visible spectrum then, selectivity is not apparent. Is there any reason to expect help from it by reason of a general increase of radiation in the visible spectrum apart from that due to increased temperature? At this point of the investigation theory stepped in with an affirmative answer. Broadly, reflecting and radiating powers stand in reciprocal relation, and radiation and absorption in direct relation. Now, in examining the reflecting powers of metals for light ranging from the extreme ultra-violet to the depths of the infra-red, certain facts stand boldly out. Practically all pure metals reflect the long wave lengths of the invisible infra-red very brilliantly and quite uniformly; therefore, one should not expect from them either generally strong or locally strong radiation. On the other hand, they all show very marked decrease in reflecting power in the visible and ultra-violet regions. Except in strongly colored metals like gold and copper, the decrease in reflective power is gradual, though striking in the visible spectrum; hence one should expect abnormally high, though generally regular, radiation in this region as compared with that in the infra-red, where, from the standpoint of luminosity, energy is wasted. Copper, which shows strongly selective reflection of the visible rays, glows green when melted in virtue of this peculiarity.

From these reasons, and others as well, still further from the apparently practical, one has reason to expect that metals which reflect visible light rather badly and infra-red light well, will prove to be abnormally good radiators of visible wave lengths when heated to incandescence. Following up this line of experiment, Coblentz finds that such metallic filaments when worked for equal luminosity in the visible spectrum actually gave relatively less waste radiation in the infra-red than other solids, and therefore their high efficiency is not due alone to high temperature but to true selective radiation for short wave lengths, not showing itself in narrow bands that are conspicuous at a glance but in a broad-band effect covering practically the whole bright part of the spectrum, although very possibly modified in the ultra-violet, as is the case, for instance, of silver, which although a magnificent reflector in the visible spectrum, is black as black velvet for a narrow space in the far ultra-violet. Comparing lamps with filaments of "metallized" carbon, tantalum, tungsten and osmium, Coblentz has found the selective increment of useful radiation in the order named, the effect being trivial in the first named and especially strong in the osmium. In all cases the matter of comparative temperature is a little dubious, so that close comparisons of radiating power are difficult to make. There is evidence of rather marked variation of the radiation constants according to temperature, and also with change of the character of the filament surface through use, which accounts, at least in part, for the erratic photometric results often obtained from metallic-filament lamps. Enough is already evident to show that there is at least a fighting chance to get a filament material which shall give a good working efficiency without being pushed to a destructive temperature, and this paper will prove a valuable signpost for the investigator.

Tariff on Flaming-Arc Carbons.

Representations are being made to Congress by flaming-arc lamp commercial interests on the injustice of the great increase of duty on flaming-arc carbons which the Payne bill would impose. It is pointed out that the proposed tax would add 50 per cent to the present duty on this class of carbons, the result of which would be still further to handicap the use in this country of the most highly efficient form of electric light known, and which is so highly appreciated abroad as shown by its rapid adoption there. The suggestion is made that instead of increasing the duty, flaming-arc carbons be transferred to the free list in view of the great benefit that would thereby be conferred on the electric lighting industry, and also because there are no indications that the manufacture of this class of carbon will be undertaken in this country, which class is even more special in character than carbons of other high grades that have always been imported, even under an exorbitant duty, owing to the impossibility or great difficulty of their domestic manufacture.

Appraisal of New England Telephone & Telegraph Company Completed.

The Massachusetts Highway Commission and experts employed by it have been engaged for the past year in securing a careful inventory and appraisal of all property of the New England Telephone & Telegraph Company. The firm of D. C. & Wm. B. Jackson, engineers and experts, of Chicago and Boston, was retained as consultant in this work, and the appraisal is in many respects the most thorough that has ever been made of a telephone property extending over a diversified territory. A summary report of the results of the inventory and appraisal has just been made by Prof. Dugald C. Jackson of the above firm, and the Highway Commission has transmitted the report to Governor Draper, with the request that a special message be addressed to the Legislature for the appropriation of approximately $35,000 to enable studies to be made by which the equitableness of the rates may be determined for different classes of service. An abstract of Professor Jackson's report will be printed in the next issue of this paper.

The commission feels that as a result of its work it is now in a position to determine not only the value of any part of the plant which the company uses in any locality, but also the value of the plant used for each class of service. Studies of traffic, cost of operation, amounts needed for repairs, replacements, construction and reconstruction, and items chargeable to capital must all be considered to determine what rates are fair and reasonable in the various localities for different kinds of service. The commission states that there appears to be room for reductions in rates, with further analysis of the work of the company, to determine where such reductions may properly be made.

The Tariff on Mica.

In the House of Representatives an amendment has been accepted making a change in the duty on mica as originally formulated in the Payne bill, whereby the tax on the smaller sizes is almost restored to its present magnitude. The present duty on mica is 6 cents per pound and 20 per cent ad valorem. This was changed in the Payne bill to 30 per cent ad valorem. Under the above-mentioned amendment crude mica will be taxed 5 cents per pound and 20 per cent ad valorem, and manufactured mica 10 cents per pound and 20 per cent ad valorem. So far as relates to non-manufactured mica the difference from the present rate of duty is in the reduction of the specific duty from 6 cents to 5 cents per pound, the ad valorem duty remaining the same.

The electrical industry is particularly interested in the small sizes of mica, as but a comparatively small amount of large plates is used in electrical manufacture, except built-up plates. The high duty on the smaller sizes of mica, which in some cases amounts to almost 100 per cent, bears severely on the electrical industry. American mica is, as a rule, not sufficiently pure for most electrical uses, and in the past the production has not been large enough to supply the market. As previously pointed out in these columns, in 1907, when the price of mica was double the price that prevailed in 1905, the domestic production was increased only by 15 per cent, while during the same period the increase in importations of mica was 300 per cent. During this period the price of mica increased over 100 per cent, and yet with only the very small increase in domestic production noted. The amount of capital employed in the mining of mica in this country is very small, and probably not over 1000 men are employed in this industry. On the other hand, all purchasers of electrical apparatus are directly interested in securing a lower duty than is conceded by the amendment to the Payne bill. The original ad valorem duty in that bill involved a great reduction in the tax on the smaller sizes of mica, and according to the newspapers the change to a higher rate was secured by the mica manufacturing interests.

Illumination Features of the Southern Electrical and Industrial Exposition.

The Southern Electrical and Industrial Exposition, which will be held April 21-24 at the First Regiment Armory, Louisville, one of the largest buildings of its kind in the country, will be notable for the class and extent of its electrical displays and especially on account of its electrical illumination features. Tungstens, Nernsts, Elblights, linolites, and, in fact, every known make of light will enter into this service. The street lighting will be done entirely with the Elblight. Nernsts and linolite will be used in the art gallery and on the floor of the Exposition wherever possible. The entire Exposition will be held under electric light both day and night, arrangements having been made to shut off all daylight. The ceiling of the Exposition will be hidden under a canopy of green cloth studded with electric lamps, the hanging decoration having been abandoned.

An enormous electric clock—in fact said to be the largest electric clock ever made—will swing backward and forward at one end of the Exposition. This clock will consist of a pendulum stem 35 ft. long, carrying five rows of electric lights and a dial 25 ft. in diameter, studded with tiny electric blubs. Five thousand electric lamps will be used on the clock. The dial differs widely from the ordinary clock dial in that although it indicates hours, minutes and seconds, it has no hands. The time by minutes is indicated by 60 series of lights, each containing 32 electric globes and radiating from an ornamental centerpiece to the outer edge of the dial. Shorter rows of different colored lights indicate the hour, and these change their position 12 times during each 60 minutes. The seconds are shown by 60 lights placed at equal distances around the extreme outer edge of the face. The hour figures are about 3 ft. high and are outlined in colored globes. Each second the illumination in the outer circle of lights moves round one, and when the entire clock has been encircled the lights indicating the minutes also advance, while the hour hand makes its slow journey at five-minute intervals.

The great central tower, which will rise 40 ft. from the floor of the Exposition, will be a glow of light, several thousand lamp bulbs being used in its illumination. The Exposition will demand 486 kw of electric power, as compared with 275 kw used at the recent Chicago show.

Another feature of the Exposition will be the exhibition of the Marconi system. An earnest effort was made to get the now famous Jack Binns to operate this system, but he is under contract to appear in Boston during the run of the Exposition.

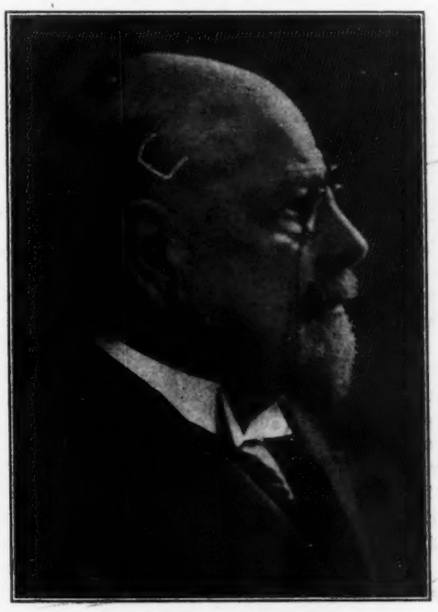
The street leading to the Armory will be a perfect glow of light, thousands of Elblights being used in this branch of the illumination.

A myriad of electric bulbs has been used on the enormous ceiling of the big Armory, and when the decorations are in place these will glow like stars in the firmament.

Emil Rathenau.

The seventieth birthday of Mr. Emil Rathenau, founder and head of the Allgemeine Elektricitäts Gesellschaft, was made the occasion also of a jubilee celebration of the distinguished manufacturer's entry into the industrial field, in which for more than a generation he has been the most conspicuous German figure. This celebration was marked by a banquet, at which were gathered leading representatives of the State, of science, the professions, the industries and of the financial world.

The Emperor wrote a letter of hearty congratulation, and was represented at the banquet by former State Secretary von Hollmann; Chancellor von Bülow and other Ministers also sent congratulatory messages. Among the members of the Government Ministry at the banquet were von Einem, Minister of War; von Studlt, Minister of Education and Fine Arts; Delbruck, Minister of Commerce, and Dernberg, Minister of the Colonies. The Mayor of Berlin and official representatives of



MR. EMIL RATHENAU.

the Berlin Chamber of Commerce, University of Berlin and a number of other distinguished bodies were present. Engrossed resolutions were presented in the name of the directors of the A. E. G., the Berlin Board of Trade, the German Electrotechnical Association and several other bodies. Prof. Dr. Slaby responded in highly complimentary terms to the toast for the guest of honor, and the remarks of Mr. Rathenau following this response are given in abstract below.

Mr. Rathenau received his academic education at a Berlin Gymnasium, and, after an apprenticeship of four years in a machine shop, studied at the Polytechnikum in Hanover and at the Technical High School in Zurich, in the latter schools following a course in engineering. He has received from the Charlottenburg Technical High School the honorary degree of Dr. Ing. (Doctor of Engineering). His earliest work was in mechanical engineering and in the manufacture of machinery, and while subsequently closely identified with electricity, his activity as a manufacturer, industrial organizer and financier has had a wide range.

In the course of his remarks, in acknowledgment of the honor paid him, Mr. Rathenau referred to his early interest in American methods of manufacturing organization and the use of special machinery. Some German manufacturers had in the early seventies imported from America special machinery, but without much success, either because its precision was not sufficiently appreciated at the time, or that the workmen lacked the necessary skill. During a visit to the United States on the occasion of the Centennial Exposition in 1876 he made a study of American industrial methods; he said he would never forget the treasure stores of the machinery hall, and returned home with a firm desire to introduce American methods into German industries. At this period he became also interested in the telephone, and endeavored to induce the Postmaster-General to adopt his plans for securing its introduction into Germany. In this he was, however, at first not successful, being informed that not more than 23 connections could be counted on for Berlin! Later the Minister offered to introduce the telephone for public service at the cost of the Government, which plan was finally carried out.

In a conversation with the late Werner von Siemens after a visit to Paris, the backwardness of Berlin in the matter of lighting as compared to Paris, where the Avenue de l'Opéra was then lighted with Jablochkoff candles, was discussed. As a result, Siemens had a dynamo designed, and Mr. Rathenau constructed the steam engine for the first portable lighting installation, which was tested at a country place. A few years later he made a visit to the Paris International Electrical Exposition of 1881, where he was amazed at the complete and practical nature of the Edison exhibit. In this connection he paid the highest compliments to Edison, whose immeasureable services to electric lighting have not, he said, met with their full meed of appreciation, as is also true with respect to his great inventions in connection with the telegraph, telephone and other electrical applications.

Upon his return from the Exposition and with the aid of German banking firms, a research association was organized, with Mr. Rathenau at its head, to investigate the technical possibilities of electric lighting. As a result of these studies the first German electric light installation was made in Berlin in 1882, and the following year the German Edison Company was formed, which in 1887 became the Allgemeine Elektricitäts Gesellschaft.

In 1884 the company sought and obtained a lighting franchise from the city of Berlin, and the Berliner Elektricitäts Werke was established under an agreement that all machinery should be purchased from the Edison company. It is interesting to note that Mr. Rathenau's idea of establishing an organization for the study of technical questions was by him applied in 1900 to an investigation of high-speed electric traction, and recently to aeronautics.

In giving some reminiscences of the early days of electric lighting, Mr. Rathenau said that to attract attention to the new method of illumination plants were installed by his company in the Union and several other clubs in Berlin. At a banquet given at one of these in celebration of the new system of lighting, the lamps gradually grew dim, whereupon Mr. Rathenau, though the guest of honor, disappeared, and in his dress suit personally attended to the plant until the morning hours, as the extinguishment of the lights at that time would have dealt a severe blow to the electrical industry. In 1884 arrangements were made for an electric lighting exposition in Munich, but, the plans going awry, the research society organized by Mr. Rathenau undertook the lighting of most of the exhibition buildings with electricity, and also the lighting of a theater in which small ballets were given. The illumination of the latter was so successful that a contract was immediately closed for the electric lighting of the Royal Theater of Munich.

In conclusion, Mr. Rathenau said that the Allgemeine Elektricitäts Gesellschaft, after 25 years of existence, commands 1000 times the capital and 3000 times the staff of the early research society upon which it was founded.

Electric Vehicle Conference in Chicago.

Considerably over 100 men interested in promoting the electric vehicle industry attended a smoker given at the rooms of the Western Society of Engineers in Chicago, at the invitation and under the auspices of the Electric Storage Battery Company, on the evening of March 31. Mr. Godfrey H. Atkin, manager of the Chicago office of the company, presided. There was a paper on the central-station aspect of the question by Mr. E. W. Lloyd, general contract agent of the Commonwealth Edison Company. Mr. J. M. Van Splunter, of the Chicago office of the General Electric Company, gave a talk on mercury-arc rectifiers. Mr. H. M. Beck, of the Chicago office of the Electric Storage Battery Company, read a paper written by Mr. Bruce Ford on "The Exide Battery," and Mr. Hanson Robinson, of the Studebaker Automobile Company, of South Bend, Ind., read a short paper written by Mr. Kennedy, of the same company, on the commercial electric power wagon. The discussion was interesting, and at the end of the meeting all present were invited to a nearby German restaurant, where the Electric Storage Battery Company was the host at a "Dutch supper." The meeting was one of several of similar character held by the Electric Storage Battery Company and it was both instructive and pleasant.

In stating the object of the meeting at the opening, Mr. Atkin noted a marked improvement in the attitude of the public toward the electric vehicle. This is due, comparing the machines of the present day with those of a few years ago, to superior mechanical construction, larger radius of operation and better care of the car by its owner or garage manager. He stated that the meeting and others like it were intended to bring together the manufacturer, the dealer and the central-station men.

Mr. Lloyd's paper, an abstract of which is given elsewhere in this issue, was a practical exposition of the attitude of the central station toward the electric vehicle, particularly in the matter of rates of payment for electricity used in charging it, based on the experience of Chicago.

Mr. Van Splunter's talk on rectifiers was of a somewhat technical nature. He explained the theory of the mercury-arc rectifier and the construction of the working machine, which he described as simple, reliable and compact. A hint he gave in relation to the tubes was that they will undoubtedly last longer if not handled too much for cleaning or otherwise. In addition to charging storage batteries he said that the mercury-arc rectifier has several other uses, as in supplying current for moving-picture arc lamps and for dental engines.

Mr. Ford's paper, read by Mr. Beck, was a very clear exposition of the Exide battery, illustrated by lantern-slide pictures. Mr. Ford said, among other things, that the life of a positive plate is practically proportional to the number of charges received, depending, however, on the treatment which the battery is accorded. The number of charges may range from 200 to 350, due to the care given the battery. The batteries should be cleaned before some positive sign of the need of cleaning is given by the operation of the battery. It was explained how thin-plate cells have more capacity for the same weight than standard cells. Nevertheless, these cells will not give as many discharges as standard cells. At the completion of his paper, Mr. Ford gave the following practical rules for the guidance of users of vehicle batteries:

1. Keep the electrolyte above the top of the plates. 2. Do not allow the batteries to remain an unnecessary moment in a fully discharged condition, and at intervals see that the battery is charged to its maximum. 3. Never replace evaporation with anything but pure water. 4. Do not make a practice of charging batteries when only a small percentage of their capacity has been taken out. This rule, however, may be modified in the case of batteries standing with little or no work, in which case they should be freshened by charging from time to time to prevent their sulphation from local action.

The paper on the commercial electric power wagon, written by Mr. Kennedy and read by Mr. Robinson, stated that nearly 4000 vehicles of this character are in use in the United States. Almost any kind of power wagon is cheaper in operation than the use of draft animals. If the commercial truck has been slow in coming into use in the United States the fact has been due to unscientific investigation of the question. Where it is proposed to substitute power wagons for animal-drawn wagons the situation should be thoroughly canvassed from an engineering viewpoint.

In the discussion Mr. Van Splunter said that the mercury-arc rectifier will, if handled intelligently, produce unidirectional current that will not injure the battery. If batteries are undercharged, they may show sulphation, and this fault may be attributed to the rectifier unjustly. Some intelligence is required to use the rectifier, as is the case with any means of charging. If thought desirable, a time switch may be arranged to cut out the rectifier in charging at a predetermined time.

Mr. H. H. Rice, vice-president of the Waverly Company, of Indianapolis, said that the electric car is a business proposition and does not conflict with the gas car. He spoke of the fact that, in the case of the rectifier, with a little calculation in arranging the charging, the arc will go out before the battery is overcharged. He said that all concerned should emphasize the simplicity of the electric carriage, the battery and the charging apparatus. The electric car is to be used just as the horse and carriage are used, except that the owner will get more out of it; but he does not need to know all the details of the apparatus and the theory on which it is based. Women may operate the electric car with ease, and emphasis should be laid on the simplicity of the vehicle. In relation to the question of rates of payment for electricity furnished garages for charging, brought out by Mr. Lloyd, the speaker did not favor the proposed mileage basis. Tires, for instance, make a great difference in current consumption. He favored a kw-hour basis. Possibly, if charging is done in off-peak hours, a flat rate may be figured out, with the idea of making the cost of electricity plain to the customer. Everything connected with the operation of the electric car should be made as simple as possible.

Mr. Ernest Lunn, superintendent of storage batteries for the Commonwealth Edison Company, spoke of the operation of a modern garage by his company, using its own commercial vehicles, of which it has had from 9 to 13 in constant service in recent years. Especially good care is taken of the batteries, and Mr. Lunn said that they had records of 11,000 miles of use with positive plates and 14,000 miles with negative plates. He advocated the amp-hour meter of the mercury type for use in charging electric vehicles to determine exactly in advance the amount of current to be put into the battery.

Keen interest in the subject was shown by everyone present and all seemed to consider the meeting very well worth while. Among the out-of-town central-station men present were: Messrs. P. H. Korst, Janesville, Wis.; Austin Burt, Waterloo, Ia.; J. S. Maltman, Kankakee, Ill.; J. W. M. Burton, Paxton, Ill., and J. J. Dawes and E. W. Osborne, Rockford, Ill. Out-of-town automobile men included, among others, Messrs. Edward C. Witwere, Studebaker Company, South Bend, Ind.; C. T. Wayne, Winona, Minn.; J. Wilkie, Sheboygan, Wis., and R. F. Garretson, Michigan City, Ind.

Manufacture of Metallic Filaments.

A patent was granted March 30 to Fritz Blau, Berlin, Germany, on a method for the production of tungsten incandescent lamp filaments. When in the process of manufacture filaments were heated to a whiteness in an inert gas considerable inconvenience was encountered, especially with very thin filaments, owing to irregular deformations of an extensive nature, often making the filaments quite useless. It was discovered, however, that these deformations were due to the use of an alternating current, and that when a direct current was used instead, they no longer occurred. The claims relate to such use of direct current in the manufacture of metallic filaments.

Electrical Illumination at Niagara Falls.

It is now assured that the work of beautifying the débris slope of the New York bank of the river below the upper steel-arch bridge at Niagara Falls is to be continued this spring. Landscape Architect Frederic Law Olmsted and Artist Millet have recently been to the Falls studying the present condition of the work done last year and the needs of the approaching season. They were accompanied by Mr. McComber, who has charge of the planting, and who has remained at the Falls to start the work of the spring. Thousands of new roots will be put in and the effort will be to improve the appearance of the bank below the new plant of the Aluminum Company of America. The necessary shrubs for the work have been ordered and will be shipped to Niagara in time for planting.

Mr. W. D'Arcy Ryan, of the General Electric Company, recently visited Niagara Falls and laid before a committee of interested citizens from Niagara Falls, Ont., and Niagara Falls, N. Y., his proposed plan for illuminating the Falls of Niagara next summer. The plans as outlined by Mr. Ryan were most pleasing to the committee, and efforts will be made to raise the funds necessary to their support. The plans call for two batteries of lights, one to be known as the Cliff battery, the other as the Gorge battery. It is planned to excavate a recess in the Canadian cliff opposite Goat Island, this shelf to be 128 ft. long and 12 ft. wide, the height of the excavation to be 10 ft. Here will be installed 20 projectors, each 30 in. in diameter. The Cliff battery will consist of 12 projectors, each 60 in. in diameter. These will also be placed in a recess which is to be 126 ft. long, 12 ft. high and 10 ft. deep, the front to have the appearance of an ancient fortification. The previous illumination was of 1,500,000 nominal candle-power, whereas the proposed illumination will be of 2,500,000 nominal candle-power.

An elaborate color scheme is contemplated in connection with the operation of the lamps. The first illumination of the Falls of Niagara under Mr. Ryan's auspices is still remembered as a fascinating night spectacle, but it is promised that the beauty of the scene will be greatly enhanced if the present plans are carried into operation.

Proposed Public-Service Commission in Illinois.

The bill introduced in the Senate of the Illinois Legislature by Senator S. A. Ettelson, of Chicago, last January, providing for the establishment of a State Public Service Commission is still pending. It has been referred to the Senate committee on corporations and public utilities, and several public hearings have been held. The hearing for the central-station interests has not been held yet, however, and no doubt managers of electrical properties in Illinois may obtain the date of that hearing, which is undecided at this writing, by applying to Mr. Ettelson at the State Capitol at Springfield.

The bill is patterned after the law creating the public service commissions in the State of New York, known as the Hughes law, except that it provides for the regulation of telephone companies as well as railroads, street railways and common carriers, companies furnishing electricity for light, heat and power, and gas companies. It may be remarked that in the present session of the New York Legislature at Albany an amendment to the New York State law, bringing telephone companies under the authority of the commissions, is pending.

It is provided that the commission shall consist of seven members, to be appointed by the Governor. The term of office shall be five years. The commission shall appoint a legal counsellor and a secretary. Its principal office shall be in Springfield and no person shall be eligible for appointment to the commission or under it who holds any position with any corporation of the class affected. Each commissioner shall receive a salary of $10,000 a year. The salary of the counsel is the same sum, while the secretary is to receive $6,000. An annual report is to be made to the Legislature.

In relation to railroads and street railways, the commission is to see that the companies furnish safe and adequate service at just and reasonable charges. Such matters as switch and sidetrack connections, tariff schedules, joint tariffs, unjust discrimination, false billing and the like, are to be passed on by the commission. It is also provided that the commission shall have power to investigate the cause of all accidents on railroads or street railways within the State. The commission may establish a uniform system of accounting to be used by railroad and street-railway corporations.

In relation to the electrical companies and the gas companies the commission is given general supervision over them. It shall from time to time examine the methods employed by these companies in manufacturing and supplying electricity for light, heat or power and transmitting it and have power to order such improvements as shall best promote the public interest. It may prescribe methods of regulation of the electric supply system and fix the initial efficiency of incandescent lamps furnished by the persons, corporations or municipalities selling electric current. It has authority to prescribe uniform methods of accounting. It shall require every person or corporation under its supervision to submit to it an annual report giving detailed information about the finances of the company, the location of its plant and system, with a full description of its property and franchises. Similarly, every municipality engaged in operating gas or electric plants is required to make an annual report to the commission. The commission has power to enter upon and inspect the properties of the corporations under its supervision and to examine their books and affairs.

Inspectors of gas and electric meters shall be appointed who are to ascertain the accuracy of all gas or electric meters used for measuring the quantity of gas or electricity furnished by any corporation. No gas or electric meter shall be used unless so inspected and stamped. If any consumer shall request the commission, in writing, to inspect his meters, this shall be done. If the meter is found to be defective to the prejudice of the consumer within 4 per cent, if an electric meter, or 2 per cent, if a gas meter, the inspector shall order the company to remove the meter, replacing it with the correct meter, the expense to be borne by the corporation. If, on the other hand, meters so tested should be found to be correct, the expense of the inspection and tests shall be borne by the consumer. A uniform reasonable charge shall be fixed by the commission for this service.

No company shall begin construction or exercise any rights or privilege under any franchise not heretofore actually exercised without first obtaining the permission of the commission. No municipality shall build any new gas or electric plant without a certificate of authority granted by the commission. All issues of stock, bonds and other forms of indebtedness by the corporations must be approved by the commission. No company may transfer or lease its franchise without the consent of the commission. Provision is made that in case of complaint of the quality of the supply of electricity by any city or village government, or by formal action of not less than 50 customers, the commission may inspect the plant and methods of the company complained of. After a hearing, the commission, "within lawful limits," may fix the maximum price for gas or electricity to be charged by such corporation, and may also order such improvements as will in its judgment improve the service.

Any corporation failing to obey the orders of the commission renders itself liable to a fine of $1,000 for each offense, and in case of continued violation, each day shall be deemed a separate offense. Provision is made for recourse to the courts to enforce these penalties.

In relation to telephone companies the commission is also given general supervision. It has power to fix the value and standard of telephone instruments and establish by regulations the quality and character of telephone service. Here also uniform methods of accounting may be prescribed. Annual reports are also required, and in general the commission has the

same powers as in the case of other corporations affected. Telephone inspectors are to be appointed to inspect the apparatus, and only approved apparatus may be used.

The act, if passed, is to take effect July 1, 1909. The public service commission thus created will supersede the present Railroad and Warehouse Commission, and all duties of that commission shall devolve on the new one. The sum of $200,000 is appropriated for the use of the commission.

Proposed Changes in New York Public Service Commissions Law.

Provision for the following changes in the Public Service Commissions law of New York State, affecting electric light and subway companies, which are understood to have the approval of the commission, is made in a bill now pending before the Legislature:

In the paragraph describing the terms *gas plant, electric plant* and *electrical corporations,* the jurisdiction of the commission is eliminated over private plants in which current is generated by the owner of a building for his own use and that of his tenants. The jurisdiction of the Public Service Commission is extended to holding companies. The commission is given the right to bring an action to vacate the charter and franchises of a corporation which is not exercising all of the franchises or is using a franchise without authority.

Five subdivisions of paragraph 65 are entirely new and relate to safe and adequate charges, unjust discrimination, unreasonable preference, etc. The jurisdiction of the commission is extended over all property owned, leased, operated or controlled by any gas or electric corporation and is enlarged as to investigations and the ordering of improvements.

Its power is extended for the purpose of determining whether the nature, class, character and efficiency of the supply system, etc., confirm to a order issued by the commission; the commission under this section has power to examine and investigate the methods and property employed in manufacturing, etc. Powers are also extended to allow orders, forms of accounts, etc., to be prescribed. The commission may, upon a hearing had upon its own motion, or upon a complaint, fix by order the proper, just and reasonable charges to be made, etc. The rate fixed, however, is subject to revision by the commission upon its own motion or upon a complaint of a corporation after the time fixed.

The power of the commission in regard to tax accounts, etc., is extended and power is given to require all corporations specifically to answer all questions upon which the commission may desire information, and also to file periodic reports and the exaction of $100 per day fine if the reports are not filed when required. Power is given to require electric corporations to print and keep open for public inspection schedules showing all rates and charges, etc. One section specifies that if it appears that a gas or electric corporation is engaged in carrying on any other business than the operating, controlling and managing of a gas plant, and if the other business is not subject to the jurisdiction of the commission and its operations are kept separate, the company, in that respect, is not subject to the provisions of the Public Service Commissions act. An entirely new section gives the commission power to appoint inspectors of electric meters, etc., and another clause authorized the fixing of uniform and reasonable charges for the inspection and testing of meters. It is provided that no person or corporation shall begin the operation of its gas or electric plant without first requesting permission of the commission nor exercise any privilege not heretofore exercised without such permission. The commission in whose district the construction is to be made or privilege or franchise exercised shall have the right to require maps, plans, etc. In giving such permission the commission may impose conditions and requirements.

Several changes are made in regard to the approval of issue of stock, bonds and other forms of indebtedness. This section provides that no short-time notes shall, in whole or in part, directly or indirectly, be refunded without the consent of the commission, and no short-time notes, without the consent of the commission, be issued to refund, extend or to provide money on short-time notes unless the specified time of payment is not more than one year from the date of the issue of the note to be refunded, extended or paid. The present paragraph relating to hearings, etc., and orders fixing the price of gas and electricity, is amended providing that the price of gas or electricity may be fixed by the commission for a period not exceeding three years until the commission, upon its own motion or complaint of corporation, etc., may fix a higher or lower maximum price.

Massachusetts Legislative Notes.

The committee on mercantile affairs of the Massachusetts Legislature has withdrawn the report on the Dean bill to establish a toll rate of 5 cents per call within 15 miles of Boston. The committee has also reported on the bill to allow the Heath Telephone Company to sell stock at a private sale, favorable action being recommended. The House has accepted the report of the same committee against allowing the Massachusetts Transmission Company to take land by right of eminent domain. The Senate has accepted the advance report of the committee on the Abbott bill to make telephone rates uniform in the city of Boston. The Haigis bill relative to the distribution of the franchise taxes of public service corporations has been referred to the next Legislature by the committee on taxation.

Magnetite Arc Lamps.

A patent issued on March 9 to Dr. C. P. Steinmetz, the application for which was filed on Feb. 26, 1902, covers the use of arc-lamp electrodes composed wholly or largely of magnetite. When the positive electrode is made of this material the arc gives off a brilliant white light having a spectrum like that of iron. The inventor states that the negative electrode need not be of magnetite because the composition of the positive electrode determines the quality of the light. He suggests the use of certain impurities, such as magnesia, lime or alumina compounds, in the positive electrode for improving the performance of the lamp.

In a patent issued to Dr. W. R. Whitney, on March 9, the use of copper for the negative electrode is disclosed. This electrode is so constructed that the heat generated by the arc will maintain it at a certain temperature which is below that of oxidation of the copper, but which is high enough to prevent the electrode from becoming too good a condenser for the products of combustion of the arc.

Industrial Education.

The educational committee of the American Institute of Electrical Engineers has secured for a special meeting to be held April 16, a paper by Dean Herman Schneider, of the University of Cincinnati, entitled "Fundamental Principles of Industrial Education." As noted from time to time in these columns, the University of Cincinnati has for several years been conducting a course of industrial education along radically new lines and, it is reported, with excellent results. Full details of this work are given in Dean Schneider's paper.

This is the first of several papers which will be presented on industrial education. The aim of the educational committee is to lay before the Institute members the problems of industrial and technical education. Last year the committee devoted its attention to the problems of technical education. This year some phases of more elementary industrial training will be presented. A plan for applying the co-operative idea in electrical engineering education was outlined in a paper by Mr. M. W. Alexander, at the annual convention last year. Dean Schneider believes that the co-operative principle applies to industrial as well as to technical training and that it can be carried out in a practical manner.

Illuminations for the Hudson-Fulton Celebration.

During the early fall New York City will devote considerable money and time to the joint Hudson-Fulton celebration, and preparations are already being made of various kinds. The city has made a special appropriation of not less than $300,000, of which $200,000 has already been approved, and numerous bodies are making plans to co-operate and participate. Day and night parades by land and sea are being organized, with special exhibitions, lectures, meetings and entertainments.

The question has now come up of special illuminations appropriate to the occasion, and plans are already under discussion. In a recent letter to Col. Henry W. Sackett, secretary of the Hudson-Fulton Celebration Commission, a number of suggestions have been submitted by Mr. Arthur Williams, general inspector of the New York Edison Company, as follows: "May we suggest that for an event of this kind nothing could be more attractive than electric illumination and decoration? This could take several forms. With or without an evening parade 'outline lighting' on the buildings facing Broadway and Fifth Avenue, or incandescent lamps, at regular intervals, looped across these thoroughfares would be very attractive. The latter was the form of decoration selected by the Inaugural Committee at Washington, though there was no night parade, and the effect was strikingly good. As you are doubtless aware, on fête and other special occasions the public buildings of Paris are shown in outline.

"Something which I think has never been attempted in this city would be the illumination of the Washington, the Union, the Madison Square and the Riverside Parks, the lamps being placed in the foliage. The mercury-vapor lamps, efficient in the use of current, produce a remarkable effect in this kind of lighting. Likewise the flaming-arc lamps, of enormous candle-power, are very attractive under these conditions. There are also several important points at which searchlights could be advantageously used. The Washington Square Arch, the Sailors' Monument and General Grant's Tomb would look well brought into bold night relief. The play of searchlights from tall buildings, including the *Times,* Metropolitan and Singer towers, the *World,* the Flatiron and other buildings, most of which have powerful lamps, would add to the scene. Many New York concerns have searchlights which we think they would be glad to use on that occasion.

"A very attractive use of searchlights might be the night illumination of the North River, much the same as the Falls are illuminated at Niagara. This occurring for one or two nights would not be expensive and would seem an appropriate use of that river at the time."

All the facilities of the New York Edison Company have been placed at the disposal of the commission, and it is suggested that other electrical companies and bodies might like to lend their aid in various ways. An electrical float has been proposed for the parade which is to be made up of typical displays of that character.

Buying Coal on a Heat-Unit Basis.

At the Minnesota Electrical Association convention at Minneapolis, March 18 and 19, Mr. Ludwig Kemper, manager of the Albert Lea Light & Power Company, gave a paper entitled "Buying Coal on a B. T. U. Basis." Mr. Kemper's company has been purchasing coal on a heat-unit contract in which the payment per ton is in proportion to the number of lb.-Fahr. units as determined by samples of each car taken by a disinterested laboratory.

Mr. Kemper first called attention to the fact that to burn coal efficiently, with the proper apparatus, the following requirements should be kept in mind: First, the fuel should be fed to the furnace as uniformly and continuously as possible. Second, the air supply should be only slightly in excess of the amount theoretically required. Third, sufficiently high temperature should prevail in the furnace to ignite the gases given off from the coal. Fourth, these gases should be completely mixed with air before they strike cooling surfaces. Fifth, boiler settings should be tight and heating surfaces clean. Some of these requirements are easier met with certain types of furnaces, grates and boiler settings than with others, but a reasonable efficiency in burning coal may be reached by careful operation of furnaces at present in commercial use. The question of generating steam resolves itself into two separate and distinct parts: first, the purchase of a fuel of suitable grade which will give the largest number of heat units for one cent in front of the boilers; second, the burning of this fuel under the boilers in such a way as to get as much work as possible from these heat units. The value of the coal is determined by the number of heat units it contains, its moisture and ashes.

The heat units are the active matter; moisture and ashes are a detriment. In purchasing coal the first matter to be decided is which grades of coal can be burned with good efficiency and without cutting down the steaming capacity of the equipment. The grades of coal suitable for the average plant range over far wider limits than supposed usually. Long years of use of certain grades of coal have made many an engineer feel that it is impossible to burn other grades; where if the test was made under proper direction and supervision often better results would have been obtained by these other grades of coal.

After deciding on the grades of coal to use, it should be bought on a heat-unit basis, making proper allowance for ashes and moisture. The fuel should not be bought on a heat-unit basis of a test car, but on a guaranteed heat-unit basis, which means that every car of coal bought contains the same number of lb.-Fahr. units. As it is impossible to get coal which is absolutely alike all the time, the contract must be made in such a way that a proportionate premium is paid if coal contains more heat units than guaranteed, and a proportionate rebate allowed if the coal contains less heat units than guaranteed.

To buy coal under such a guarantee, it is necessary to have all the coal tested during the year. This, of course, should be done by a disinterested party at the expense of the consumer.

After coal is purchased in this manner the extraction of the heat units out of the fuel and the transmission of them to the heating surfaces must be brought about. How to do this the author does not state; but he recommends two items, which will enable one to gage the results obtained in the operation of the boilers, the testing of flue gases for CO_2 and temperature. If the percentage of CO_2 in the flue gas is low, it means that the boilers are running inefficiently and if the flue temperatures are high, it means that the heat is going up the chimney instead of into the boiler.

By buying coal under strict specifications and guarantees and by watching boiler-room operation, Mr. Kemper says the station manager will be able to reach better economies than heretofore; and will find that expenditures made for this purpose will prove a good investment.

In discussing this paper Mr. Kemper was asked the cost of testing for heat units under such contract in a plant using 1200 lb. fuel per year. Mr. Kemper replied that this would probably be from 10 cents to 15 cents per ton. While this might seem like a high price to pay simply for testing, it is not when it is considered that coal not purchased under a heat-unit contract is likely to average from 4 to 8 per cent below that purchased under such a contract, the original sample car being the same in both cases. The reason for this is that more care will be taken by the miners and dealers in selling coal for shipment on heat-unit contracts than for ordinary contracts. His company has operated under such a contract for three years. It is found that the coal purchased in the winter is likely to be lower in heat units than that purchased in the summer. He gave as a reason for this the fact that in summer more careful selection can be made at the mines. In the winter, when there is a great demand for coal, the miners ship the coal as fast as it can be taken out, without selection. This would seem to indicate that no selection would be made at any period of the year for contracts not on a heat-unit basis.

Ten-Year Lighting Contract Under Consideration in Boston.

Mayor G. A. Hibbard, of Boston, is considering a 10-year contract of the city with the Edison Electric Illuminating Company for general street illumination. Superintendent of Streets Guy C. Emerson has been making a thorough study of the matter within the past few weeks, and has given various interests an opportunity to demonstrate what they can do with different kinds of lamps at prominent locations in the city. Mr. Emerson has reported to the Mayor that in his opinion the best results are those obtained by the Edison company with the magnetite arc lamp. A contract has been drawn up by Superintendent Emerson providing for the use of the magnetite lamp, and on the basis of the number of lamps at present in use it is estimated that the cost of lighting the city per year will be $360,000, which means a saving of $75,000 per year of the present expense. It is stated that the Mayor's principal cause for hesitation is the term of the contract, although this is a customary length in Boston. The last contract with the Edison company expired on March 20, and since then the city has been paying for its lights at the same rates as were then in operation.

Graphitized Carbon-Filament Patent.

A patent granted March 30 to Dr. W. R. Whitney, on an application filed Feb. 8, 1904, relates to the graphitized carbon filaments of the type used in the "Gem" lamp. Research led to the discovery that if an ordinary carbon filament be heated at certain extreme temperatures in a carbon-tube electric furnace the characteristics of the filament undergo some remarkable changes. Thus, the cold resistance of the filament is very much lowered, while the resistance at running temperatures is not appreciably reduced. A lamp with a filament thus treated, if run at such a candle-power as to give it the life of an ordinary carbon lamp, has a higher efficiency, or if the lamp is run to give the same efficiency, its useful life is increased. The process, in brief, consists in firing an ordinary base filament at a very high temperature, allowing it to cool, then subjecting it to the ordinary flash or treating process, whereby it receives a deposit of graphitic carbon, and then firing it again at a very high temperature. The specifications describe minutely every detail of this process and include much general information on the subject of incandescent lamp manufacture and on the phenomena involved.

New York Public Service Commission News.

The Public Service Commission of the First District of New York has approved the proposal of the Hudson & Manhattan Railroad Company to construct a subway from Thirty-third Street under Sixth Avenue and Forty-second Street to the Grand Central Station. The proposed plans of the company have been slightly changed, at the suggestion of the commission, so that the extension will not interfere with the building of any future subways either under Broadway, Thirty-fourth Street, Forty-second Street or Lexington Avenue. The proposed tunnel will occupy the next level beneath that of the present subway. The station will be from Park Avenue east toward Lexington Avenue. The construction of this station will forestall any extension of the Interborough's subway through Forty-second Street to Lexington Avenue, but the commission points out that there will be no difficulty about making connection with Lexington Avenue through Forty-first Street. The commission also finds that it will be necessary for the Interborough to abandon the pipe gallery it recently constructed connecting the present subway with the Steinway tunnel. The terms of the franchise have not yet been fixed by the commission and will not be determined until after the public hearing on the matter which has been set for April 21. It is presumed that the franchise will be similar to that now held by the Hudson & Manhattan Railroad for its tunnel under Sixth Avenue from Ninth Street to Thirty-third Street. This provides for a 25-year period from the date on which operation was begun, giving the city the right to purchase at any time after that by paying the original cost of construction. The tunnel company also pays the city $9,000 a year and 50 cents a year per lineal foot of single-track line as rental for the first 10 years and $15,000 a year and $1 a foot for the last 15 years. The tunnels from the State line under the Hudson to the Church Street terminal and to Ninth Street and Sixth Avenue were granted under separate franchises and pay the same rental charges, but the city is not given the right to buy.

Concerning this tube, Mr. Frank Hedley, general manager of the Interborough, testified before the commission that the gallery was constructed entirely for the purpose of carrying cables which would enable the Interborough company to supply energy from its power house in Manhattan, not only to the Steinway tunnel, but also to the trolley lines of Queens Borough. The Interborough company is largely interested in these properties, and it is intimated if the Steinway tunnel is put into operation in connection with the present subway that this interest will be largely increased.

It came out at the hearing before the Public Service Commission that the Steinway tunnel under the East River is all wired with the overhead rail and that it can be opened for traffic at any time when a suitable arrangement for operation is concluded.

The Hudson & Manhattan Railroad has notified the Public Service Commission that it has put into operation the suggestion made by the Women's Municipal League that the rear car of each train be reserved for women. The experiment having proved popular with the women passengers, the general manager of the Interborough has notified the commission that he is ready to adopt the plan in the subway whenever the commission makes the request.

The Public Service Commission of the First District of New York has sent to the Legislature a report upon the Eleventh Avenue franchise of the New York Central. The report is a comprehensive review of the history of the franchise and of the various acts of the Legislature that refer to it. No opinion is expressed as to the validity of the franchise, but the impression is given that the commission considers the railroad's right as questionable. The chairman of the commission has also sent Ira A. Place, vice-president of the New York Central, a letter in which he expresses objections to many features of the railroad's pending bill for the construction of a combination elevated and subway freight line in Eleventh Avenue. The proposed bill repeals the Saxe law, which contemplated the construction of a freight subway.

The Board of Estimate of the City of New York has come to the conclusion that the Public Service Commission is spending too much money and has voted to cut down the appropriation from $987,500 to $800,000.

The commission has voted to defer action upon the application of Receiver F. W. Whitridge, of the Union Railroad Company, for a franchise to extend his line from Third Avenue, along Pelham Avenue to the Southern Boulevard. The Board of Estimate granted this franchise March 1, and while the commission admits that there is a public necessity for the line, it disapproves of some of the features of the proposed franchise.

Authorization has been given by the Public Service Commission of the Second District of New York to the New York, New Haven & Hartford Railroad to purchase all the stock of the New York & Portchester Railroad Company and of the New York, Westchester & Boston Railway Company. The effect of this purchase is to do away with the Millbrook Company, the holding organization of the New Haven company. The New Haven officials stated at the hearing that it was their intention to complete the construction of the New York, Westchester & Boston line at once, except where that line and the Portchester line were permitted to consolidate. A bill for that purpose is now pending in the Legislature.

Non-Sparking, High-Power Factor, Single-Phase Series Motor.

In a lecture before the Franklin Institute, on March 11, Dr. A. S. McAllister described a type of single-phase commutator motor which operates without sparking and at very high-power factor throughout a considerable range of speed.

The circuit diagram of the motor is given in Fig. 1, while its operating characteristics are indicated in Figs. 2 and 3. The machine is similar in construction to an inter-pole direct-current motor equipped with compensating coils for counterbalancing the armature m.m.f. The flux in the commutating pole is in time-quadrature with the main field flux and has a value which varies inversely with the armature speed. This flux is produced by a m.m.f. which is the resultant of two m.m.fs. in opposition, one of which varies directly with the value of the main field flux and the other with the product of the field flux and the speed. The latter m.m.f. is produced by the current in the secondary of a transformer whose primary is connected across the brushes on the armature. The former m.m.f. is due to a current in a circuit—largely non-inductive—connected in parallel with the main field windings.

As noted in Fig. 2, the flux obtained at the commutating pole differs throughout a large speed range by only a small amount from the value for perfect neutralization of the transformer e.m.f. produced in the coil under the brush so that non-sparking conditions are obtained during normal operation.

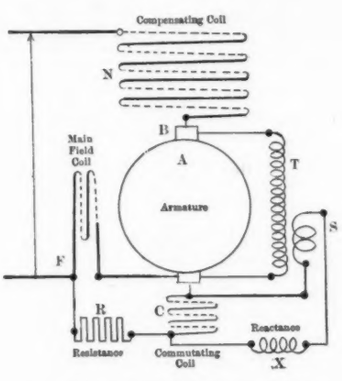


FIG. 1.—CIRCUITS OF MOTOR.

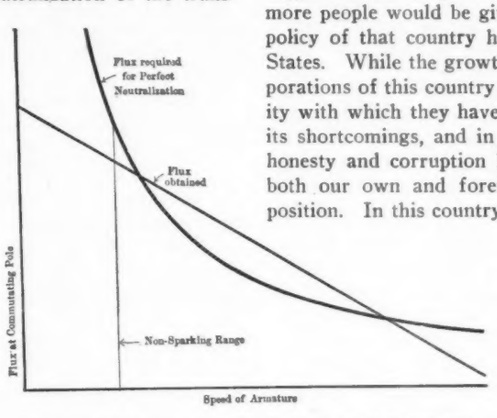


FIG. 2.—RELATION OF FLUXES FOR NON-SPARKING.

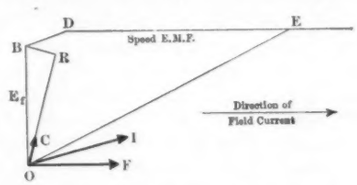


FIG. 3.—RELATIONS OF CURRENTS FOR POWER-FACTOR IMPROVEMENT.

The current which exists in the circuit in shunt with the field winding not only provides a component of m.m.f. for the commutating pole, but it has a condenser effect upon the motor circuits, as shown in Fig. 3. In this illustration OF is the constant value and phase position of 1 amp of field current. OB is the e.m.f. impressed across the main field coil; this e.m.f. is also impressed across the circuit composed of the commutating coil and the resistance in series. The e.m.f. across the commutating coil is represented by the line BR, while the e.m.f. across the resistance is shown by OR; the current through this circuit is shown by OC, being in time-phase with OR and in time-quadrature with BR. The resultant current through the armature and compensating coil is OI, which is the vector sum of OF and OC. BD shows the voltage consumed in the resistance of the armature and compensating coil circuits.

Under speed conditions there is generated at the armature an e.m.f. in time-quadrature with OB; such an e.m.f. is shown at DE for a certain value of speed; at this speed the total impressed e.m.f. is OE, while EOI is the angle of lag of the current behind the e.m.f. When the speed reaches a higher value the e.m.f. lags behind the current—that is, the current is in time-advance of the e.m.f., so that it possesses a leading quadrature wattless (condenser) component. Under all speed conditions the time-lag of the current is decreased by the angle FOI below the value with unshunted field coil, and hence the power-factor is improved to a corresponding extent.

Discussion on Public-Service Commissions.

At the meeting of the Electric Club of Chicago on March 31 the subject of public-service commissions was discussed. Prof. A. A. Radtke, consulting engineer and professor of electrical engineering in Armour Institute of Technology, was the principal speaker. He began by pointing out that the policies adopted in Europe and in this country in relation to the treatment of public-service corporations are almost diametrically opposite. Abroad the attitude of governments has hampered the growth of public utilities. These governments fail to recognize the fact that a new enterprise is in danger of being superseded by some later advance, and that capital cannot take a large risk unless compensated by proportionately large privileges.

In the United States, generally the policy has been to grant public-utility companies an open field, and to foster private ownership. New enterprises require the utmost freedom during the period of their growth. Government control interferes with such advancement and should not be encouraged. Comparing the two methods, it is seen that the people of the United Kingdom have one-quarter of the street-railway facilities, one-third of the electric lighting facilities and less than one-quarter of the telephone facilities that they must have before they are as well supplied as the people of the United States. In addition, 120,000 more people would be given employment in Great Britain if the policy of that country had been similar to that of the United States. While the growth and strength of the public-utility corporations of this country must be attributed to the broad liberality with which they have been treated, the policy is not without its shortcomings, and in this country the tares of political dishonesty and corruption have been reaped. But the policies of both our own and foreign countries are swinging to a mid-position. In this country the movement has resulted in the partial control of public-utility concerns by commissions, while abroad there have been legislative amendments to previous laws.

Professor Radtke devoted some time to a discussion of the Massachusetts law. A State commission in that State has control of the public-utility properties. This commission has numerous duties, including the regulation of rates, the issuing of stock and bonds, the approving of new companies and the testing of meters. Last year it had under its control the affairs of 143 companies. The commission benefits the existing public-service companies by limiting ruinous competition in one field. In fact, it must first be established that there is room for a rival company before a petition for a franchise can meet approval. The efficiency of this system is attested by the fact that 70 per cent of the companies pay from 5 to 20 per cent dividends.

The speaker then referred to the work of the public-service commissions of the State of New York, citing particularly the application of the Long Acre Light & Power Company, of New York City, for permission to issue a large amount of stock and bonds. The petition was denied by the commission of the city district, which said that while for a time both city and commercial lighting might be offered by both companies at a considerably reduced rate, it might be expected that competition under such conditions would be sure to be expensive, even though for a time apparently economical or profitable. Experience shows that a new company entering a territory already occupied does not necessarily depend for its financial success on the sale of electricity to the city and its citizens. It has been repeatedly demonstrated, said the commission, that the profits of the new concern do not so much depend upon its dealings with

the public as upon relations which it may be able to establish with the company first in the field. The temporary advantage to a portion of the public is reasonably sure to be followed by an undue burden upon the public as a whole through the larger capital demanding a return, much of it representing an unwarranted duplication of property as well as losses. In closing, the speaker referred to Senator Ettelson's bill for the establishment of a public-service commission now pending in the Illinois Legislature. He thought that this bill was worthy of the support of the members of the Electric Club.

In the discussion, Mr. Fred. J. Postel expressed his belief that the idea of a public-service commission is a good one. However, too many or too minute and burdensome rules may create an injustice. Thus, in the question of rates, it may be a great advantage to a central-station company to be able to take some particular business at low rates where the company can control the time when the electricity will be used and thus materially improve its load factor. But it is possible that some public-service commissions in fixing rates will not take this situation into account. Answering this objection, Professor Radtke said that in Massachusetts the commission was always open to petition. It knows exactly the condition of a company's affairs, having access to its books. No hardship is thrust on any company, and the commission is not disposed to hamper the company in taking any legitimate business.

Speaking as a central-station man Mr. H. E. Niesz, of the Commonwealth Edison Company, said that the general results of the work of public-service commissions to date have been quite satisfactory, both to the public and to the public-service corporations. It is to be borne in mind that the expense of maintaining such commissions is sometimes great, as has been shown in the case of the New York commissions, and as it is the taxpayers' money that is being spent, the fact may well be borne in mind in discussing the subject. The speaker did not believe that the central-station companies, as a general rule, object to public-service commissions. These companies have nothing to conceal. But he pointed out that with regulation must come a measure of protection for the companies. If the rates are to be fixed, the company must have the privilege of earning money for its stock and bond holders and also for the development of its field, without the fear of unfair competition or of confiscation. Mr. Niesz gave it as his opinion that the central-station business in this country is on a basis of profit smaller than that of almost any other industrial business.

Mr. Perry R. Boole asked if public-service commissions oversee municipal as well as private plants. Professor Radtke answered that he believed this to be the case, particularly in Massachusetts, where no favoritism is shown to the city plant. He said that in many instances municipal plants had been started long after the private company came into existence, and had reaped the benefits of the latter's pioneer work. Mr. W. D. Ray, of the Sanitary District, remarked that the character of the men composing the public-service commissions shaped, to a large extent, the policy and action of those bodies. In Illinois this will be as true as in other States. Mr. Ray believes that the commission idea is a step in advance. Mr. H. F. Holland told of the working of the Massachusetts law from his own personal observation. He said that a municipality cannot put in a new plant in that State without first offering to buy the existing plant, if there is one, at a fair price. His experience has led him to favor the commission idea.

On motion of Mr. W. R. Bonham, the civic committee of the club was instructed to report on the proper attitude for the club to take toward the Ettelson bill.

Museum of Safety and Sanitation.

Announcement has just been made of the election of the following officers of the Museum of Safety and Sanitation: Acting-president, Mr. Philip T. Dodge; vice-presidents, Messrs. Charles Kirchhoff, T. C. Martin, Prof. F. R. Hutton and R. W. Gilder; treasurer, Mr. Robert A. Franks; plan and scope committee, Prof. F. R. Hutton, Mr. William J. Moran, Dr. Thomas Darlington, Messrs. H. D. Whitfield and P. T. Dodge; director, Dr. William H. Tolman. Among the charter members are Messrs. P. H. Dodge, Elbert H. Gary, Richard Watson Gilder, Dr. Thomas Darlington, Charles Kirchhoff, T. Commerford Martin, Philip T. Dodge, Prof. E. R. A. Seligman, Irving Fisher, William J. Moran, Henry D. Whitfield, A. R. Shattuck and Prof. F. R. Hutton.

The Museum of Safety and Sanitation has its office at the Enginering Societies Building, 29 West Thirty-ninth Street. The objects of the museum are to study and promote means and methods of safety and sanitation and the application thereof to any and all public or private occupations whatsoever, and of advancing knowledge of kindred subjects; and to that end to establish and maintain expositions, libraries and laboratories and their branches, wherein methods and means for improving the general condition of the people as to their safety and health may be studied, tested and promoted, with a view to lessening the number of casualties and avoiding the causes of physical suffering and of premature death, and to disseminate the results of such study, researches and tests by lectures, exhibitions and other publications.

A 6600-Volt Single-Phase Railway.

A 77.5-mile, single-phase railway has been placed in operation between South Bend, Ind., and Pullman, Ill. The line is known as the Chicago, Lake Shore & South Bend Railway. The rolling stock at present consists of 48 passenger cars, 12 flat cars, 1 snowplow and 1 utility car. Each of the larger passenger cars is equipped with four 125-hp Westinghouse single-phase motors arranged for multiple-unit control. Along the main portion of the route use is made of a trolley e.m.f. of 6600 volts, but through the cities and in the shop and yards the trolley e.m.f. is lowered to 700 volts. In each case single-phase current is utilized, no direct current being employed. Thus the control equipment retains the simplicity of the single-phase outfit. The trolley wire is of No. 4-0 groved section supported by a ½-in. steel catenary cable. There are 10 substations. Two are at the terminals of a 33,000-volt transmission line and eight are used for supplying energy at low tension in the city section and in the car shops near Michigan City. The cars are provided with both wheel and pantograph collectors; the latter is used only at 6600 volts, while the former can be operated at either 700 volts or 6600 volts.

Improved Street Lighting in Boston.

The Edison Electric Illuminating Company, of Boston, has installed 21 magnetite arc lamps of the 6.6-amp size on Tremont and Boylston Streets and Commonwealth Avenue to demonstrate the capability of these large units to meet the general conditions of illumination in that section of the city. Pending the signing of a new contract between the city and the company, the same prices that prevail with the enclosed arcs now in service, $118 per year per lamp, will be used as the basis of payment. The street department is now considering an offer of the company for lighting by magnetite lamps at a reduced rate, the total number of arcs under consideration being 3800. The experimental magnetite lamps are mounted on 25-ft. poles. At Copley and Park Squares and on the parade ground of Boston Common a number of General Electric flaming arcs have been installed experimentally on poles 50 ft. high. On secluded streets in the West Roxbury, Dorchester and Brighton districts about 1000 40-cp tungsten lamps have displaced naphtha lamps at a saving of about $10,000 per year to the city, and in the business districts about 50 gas-mantle lamps have been displaced with a saving of $1.50 per lamp per year. The city has tried and rejected some gas lamps with automatic clockwork lighting attachments, which were installed in the Back Bay district.

CURRENT NEWS AND NOTES.

NO PATENT RETALIATION.—The committee in charge of the Payne bill has announced the omission of the retaliatory patent section.

SKY SIGNS LEGAL IN NEW YORK CITY.—The New York State Board of Appeals has affirmed the right to erect sky signs on the roofs of New York City buildings.

TESLA GAS TURBINE.—Nikola Tesla has announced the invention of an explosive gas turbine whereby sea-going vessels may, he states, be propelled at from 40 to 50 knots an hour.

THE EARLIEST OHM.—A correspondent writes that in a book printed in 1836 he found the word "ohm" employed to designate a wine measure used in Strasburg, the content being 12.96 English-gallons.

CONNECTICUT INSPECTOR OF ELECTRIC-LIGHT METERS.—An act has been introduced in the Connecticut Legislature providing for the inspection of gas and electric meters, and for the appointment of an inspector and deputies.

GOLD MEDAL FOR EDISON.—The Royal Academy of Sweden has awarded to Mr. Thos. A. Edison the Adelskiold gold medal for his inventions in connection with the phonograph and the incandescent lamp. This medal is conferred only once in 10 years.

SLIDING SCALE HEARING IN BOSTON.—The committee on public lighting of the Massachusetts Legislature has concluded hearings on the bill to allow gas and electric light companies to adopt a sliding scale system. Counsel A. E. Pillsbury concluded his argument in favor of the bill on March 30.

NEW YORK TO CHICAGO BY TROLLEY.—The completion of the Kensington & Eastern Electric Railway between Chicago and South Bend, Ind., gives a continuous trolley connection between Chicago and Cleveland. Between New York and Cleveland there are yet several breaks in trolley connection.

N. E. L. A. RAILROAD RATES.—The Central Passenger Association has authorized a rate of a fare and three-fifths on the certificate plan from points in its territory to Atlantic City and return for delegates to the thirty-second convention of the National Electric Light Association to be held June 1, 2, 3 and 4.

GOVERNMENT WIRELESS WAVE LENGTH.—The Junior Wireless Club of New York City has petitioned the United States Government to establish a definite wave length for army and navy wireless service in order that private wireless stations may select wave lengths that will not interfere with such service.

NEW YORK WIRE SUBWAYS.—The United States Supreme Court has decided against the New York Lines Company in a case involving its right to construct underground wire subways and conduits in New York City. This decision secures the monopoly of such service to the present company controlled by the New York Edison Company.

FESSENDEN WIRELESS TELEPHONE SYSTEM.—In a newspaper interview Prof. Elihu Thomson states that Prof. R. A. Fessenden has developed a wireless telephone system which is so successful that the Navy Department failed to interfere with the waves in recent tests of the system. He added that before long it is confidently believed that talking by wireless telephone will become a feature of everyday life in New England.

THE ELECTRIC VEHICLE AT THE N. E. L. A. CONVENTION.—The electric vehicle promises to be one of the conspicuous features of the coming National Electric Light Convention at Atlantic City. Aside from exhibits of automobile storage batteries, apparatus and accessories, it is probable that manufacturers will show the latest types of their vehicles.

WIRELESS EMERGENCY NEWS STATIONS.—The Buffalo *Evening News* in establishing a wireless station said that it was installed in order to enable the paper to receive its news when telegraph and telephone toll lines are thrown out of service by storms. The Pabst Brewing Company has also installed a wireless plant in order to be less dependent upon unreliable wire telegraphic service.

"WIRELESS" FOR HOTELS.—Following the lead of the Waldorf-Astoria Hotel, New York, a wireless-telegraph outfit will be installed on the roof of the Auditorium Annex Hotel in Chicago by the United Wireless Telegraph Company, of New York. It is said that similar equipments will be placed in hotels in St. Paul and Duluth, Minn., and perhaps in Buffalo and other cities. In addition to the Waldorf-Astoria in New York the Bellevue-Stratford in Philadelphia is now so equipped, and messages are exchanged satisfactorily between these stations and also with vessels on the Atlantic.

GAS ENGINES VS. STEAM TURBINES.—In a discussion at the March meeting of the Cornell University A. I. E. E. branch on the Institute paper by Mr. B. R. Shover on the Gary electrical plant, Prof. R. C. Carpenter compared the cost of the installation and operation of gas engines and steam turbines and expressed the opinion that the latter installation would result in a lower cost per kw-year. This was explained in part as due to the high rate of depreciation which obtains in gas engines, because of the dust in producer gas and to the high cost of repairs.

BRITISH REVOCATION OF FOREIGN PATENT.—In the first court review of the revocation of a patent under the new British patent law, it was held that the policy of the act was to secure fair play, and not protection, which Parliament could always secure whenever it thought fit. In the present case the patent was granted in 1900 for the manufacture of stone tiles or slabs. The important point was that, although worked in France, Germany and Belgium, it has never been worked in Great Britain. The court held that a new British industry might have arisen if the patent rights had been fairly used between Great Britain, this country and foreign countries and there was no evidence that there were economic conditions or other causes which precluded the new industry being started here. The revocation of the patent by the Comptroller was justified, and the appeal from the decision dismissed, with costs.

PROF. H. H. NORRIS, who for the past 13 years has been connected with the faculty of Cornell University, has been appointed head of the Department of Electrical Engineering, a position formerly held by Prof. Harris J. Ryan, now of Stanford University. Professor Norris pursued studies in engineering at both Johns Hopkins and Cornell, receiving the degree of M.E. from the latter university in June, 1896. He served as instructor in electrical engineering at Cornell from 1896 until 1901, when he was appointed assistant professor of electrical engineering. Since 1905 he has served as professor of electrical engineering. Professor Norris was superintendent of the Electric Railway Test Commission at the St. Louis Exposition in 1904. He is a frequent contributor to the technical and semi-technical press on electrical subjects, and is the author of several text-books. He has been active in the affairs of the American Institute of Electrical Engineers and is chairman of its educational committee. His name appears on the official A. I. E. E. ballot for the coming election as a nominee for manager.

SOUTHWESTERN ELECTRICAL CONVENTION.—The Southwestern Electrical and Gas Association will make a special effort to have a comprehensive trade exhibition in connection with its coming convention in May at Dallas. The Electrical Contractors' Association of Texas will hold its annual meeting in connection with the Dallas convention.

AN ELECTRIFIED POLICEMAN.—A St. Louis policeman has applied for transfer to a beat where he will not be subject to the baleful influence of escaping electricity. At present he is stationed at a street crossing in order to pilot people across electric railway tracks, and he claims that stray electricity seeping through the ground in that vicinity is injuring his health.

ENGINEERING STUDENTS' TOUR.—Ninety students of the department of electrical and mechanical engineering of the Ohio State University are making a tour of inspection of the principal industries of the Central West. On April 3 they visited the plant of the Fort Wayne Electric Works, the General Electric Lamp Works and the works of the Western Gas & Construction Company at Fort Wayne, Ind., and also the electrical power plants located there.

PANAMA WIRELESS STATION.—The Navy Department will soon open a wireless station at Porto Bello, Isthmus of Panama. A mast 130 ft. high is being erected at one of the hills at the entrance of the harbor. The work is being done under the supervision of Major Fuller, of the Marine Corps, in command at Camp Elliott. The station will be used for general naval purposes and, in addition, official messages of the Isthmian Canal Commission will be transmitted between Porto Bello and the wireless station at Colon.

NEW YORK ELECTRICAL SOCIETY AT THE HIPPODROME.—The New York Electrical Society held a special meeting on the stage of the New York Hippodrome, after the regular evening performance on March 31. Mr. Arthur Williams described the electrical equipment upon which the effectiveness of most of the scenes depends. Although use is made of 7000 incandescent lamps, 110 arc lamps and 250 hp in motors, the whole equipment consumes only 800,000 kw-hours per year. The energy is supplied by the New York Edison Company. A description of the electrical equipment of the Hippodrome was given in our issue for May 5, 1906.

STEAM ALUMNI ASSOCIATION OF PRATT INSTITUTE.—The alumni of the evening classes of '06, '07, '08 and '09 in steam and the steam engine at Pratt Institute held a dinner at the Imperial, Brooklyn, on April 3, at which the Evening Steam Alumni Association of Pratt Institute was formally organized. As many of the graduates of the institute are employed in New York and vicinity the association is to meet once a month, except during the summer, to discuss operating problems and present papers on subjects of general interest. The officers of the association for 1909-10 are: Mr. P. V. Wheeler, president; Mr. Archibaud Hill, first vice-president; Mr. E. W. Cavanagh, second vice-president; Mr. M. Chalmers, assistant instructor in steam engineering, secretary-treasurer; Messrs. F. C. H. Bull, L. J. Radin and John E. Audley, executive committee.

MICHIGAN TELEPHONE TAXATION.—A bill now before the Michigan Legislature provides for an ad valorem tax on telephone and telegraph companies instead of a specific tax as is now assessed. The measure was advocated by Governor Fred M. Warner in his pre-election speeches and was endorsed by the Republican State convention at its meeting in Detroit last fall. The specific tax now assessed on telephone companies is 3 per cent of gross earnings. Opponents of the ad valorem tax have a substitute measure raising the specific tax to 4 per cent, and the war rages around the two measures. Another measure is before the Legislature to bring the telephone and telegraph companies under the control of the State Railroad Commission and providing for an interchange of messages between competing companies. This latter measure has passed the House. The measure gives the commission power to fix rates.

CALIFORNIA HEROULT ELECTRIC FURNACE PLANT.—The electric process iron smelter of the Noble Electric Steel Company at Héroult, Cal., is about to be started up. The cost of electrical energy at Héroult is $12 a horse-power or $16 per kw-year. In an experimental furnace which made several test runs last year, it is stated that 1½ tons of iron were produced per day at a cost of $4.20 for electric energy per ton of pig iron. With the larger furnace now nearing completion, there will be produced from 15 to 20 tons of pig iron a day, with an expenditure, it is believed, of $4 per ton for electrical energy. It is claimed that iron can be made at the plant for $16 a ton. The electric smelting furnace for iron ore consists of a concrete stack 20 ft. high, with electrodes fixed in the walls of the crucible, the charging being done from the top, so that a long column of charge is preheated before it reaches the fusion zone between the electrodes. The electrodes are 24 in. apart.

FIRE DAMAGE TO TELEGRAPH OFFICE IN ROCHESTER.—Associated Press dispatches report that a fire in Reynolds Arcade, Rochester, N. Y., on March 30, caused, among other damage, considerable loss to the local office of the Western Union Telegraph Company, which is in the building. For a time telegraphic communication was interrupted. The total loss is estimated at $250,000, but only a portion of this will fall on the telegraph company. Rochester is a city possessing a peculiar significance to persons familiar with early telegraphic history, for it was the home of Hiram Sibley (after whom Sibley College at Cornell University was named) and of a number of others who made fortunes by their foresight in perceiving, in the early days, the great possibilities of the electric telegraph. One of the associates of Mr. Sibley, and an intimate friend, was Don Alonzo Watson, who for many years had a dingy office in Reynolds Arcade. Mr. Watson was reputed to be the possessor of a large amount of ready cash, and his office in Rochester was somewhat analogous to that of the late Russell Sage in New York. Mr. Sibley, Mr. Watson and their fellow investors in early telegraphic securities have all been dead for a number of years.

RAILROAD ELECTRIFICATION IN CHICAGO.—In its annual report to the City Council of Chicago on March 29 the retiring committee on local transportation referred to the electrification of steam-railroad terminals in Chicago in the following terms: "This work is of such a radical nature and will require such a great expenditure of money to carry it out that much time is required to prepare for undertaking the actual work. This committee believes that substantial progress is being made by the Illinois Central Railroad Company in its investigation of the question." At a conference held on April 1 between representatives of the Chicago city government and the Illinois Central Railroad it was said that the railroad company is working out plans for the electrification of its suburban service at an estimated cost of $8,000,000, but that it is unable to give any information relating to the time when it will actually begin construction work. President Harahan, of the railroad company, is thus reported: "We have only made a small start on the plans, and we are not out of the woods yet. The proposition is so big that anyone would be foolish to hazard a guess as to when we shall be able to begin construction." Nothing was said about the suggestion of Mr. E. H. Harriman, perhaps not made very seriously, that the city pay half of the expense of the terminal electrification.

An Austrian Central Station Operated by Oil Engines.

IN medium-sized European towns it frequently happens that the municipal gas works, after many years of service, having reached the limits of their capacity, the future wants of the population must be provided for either by extending the works and their pipe system or constructing an electric power house. In the majority of cases the latter alternative is given the preference, electrical energy being better adapted than its competitor to supply the light, heat and motive power required under the most variable conditions by the population of a town.

The superiority of electricity, apart from its undoubted advantages as an illuminant, is also acknowledged for motive power as gas engines hardly lend themselves to the variable requirements of small consumers, and while suitable for buses are out of the question when increasing traffic calls for the construction of a street railway. In choosing the prime mover for the dynamos, in case there are no waterfalls or collieries in the neighborhood, oil engines have been preferred very frequently of recent years because of their small space requirements, easy superintendence and the fact that they are always ready to work at a moment's notice.

A typical instance of a municipal electric plant designed for Diesel engine operation is the power house recently constructed by the Austrian Siemens-Schuckert Works for the old Moravian town of Iglau. This plant supplies the town and its surroundings with electricity for all purposes in addition to feeding an electric railway 2.5 km in length, recently substituted for the old omnibus line connecting the town and railway station. A pleasing power house was erected midway between the railway station and the town, and was provided at first with two three-cylinder engines of 200 hp, driving two alternating-current generators rated at 165 kv-amp and wound for 2400 volts at a speed of 187 r.p.m., with exciters mounted on the same shaft. A two-cylinder Diesel engine of 130 hp was subsequently installed and drives, through belt transmission, a set consisting of a 106-kv-amp, 2400-volt alternator and a 32-kw, 500-volt direct-current dynamo intended for feeding the railway load. Oil tanks of a capacity sufficient for several months' supply have been provided. Tests made have shown only 272 grams of oil, as against the warranted consumption of 300 grams, to be used up for each kw-hour on full load. A motor-generator set, consisting of a 50-hp high-tension motor with slip-rings direct coupled to a 32-kw direct-current generator is also installed for feeding the railway load during the time the small Diesel engine set is not in operation. One of the larger sets supplies the energy to the motor driving the generator. There is also a battery floating on the railway circuits, which can be used as reserve equipment in emergencies.

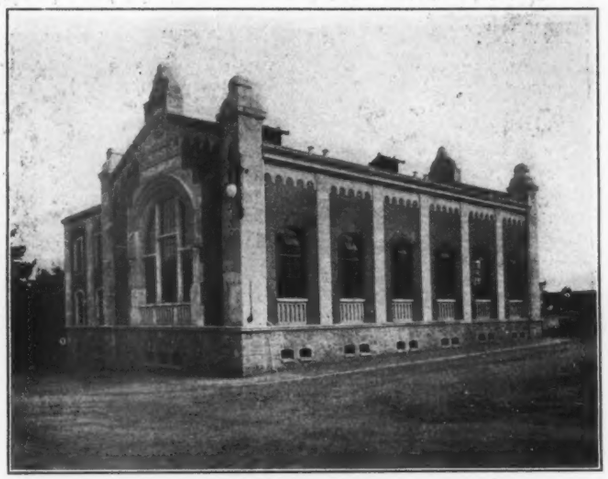


FIG. 2.—EXTERIOR VIEW OF CENTRAL STATION.

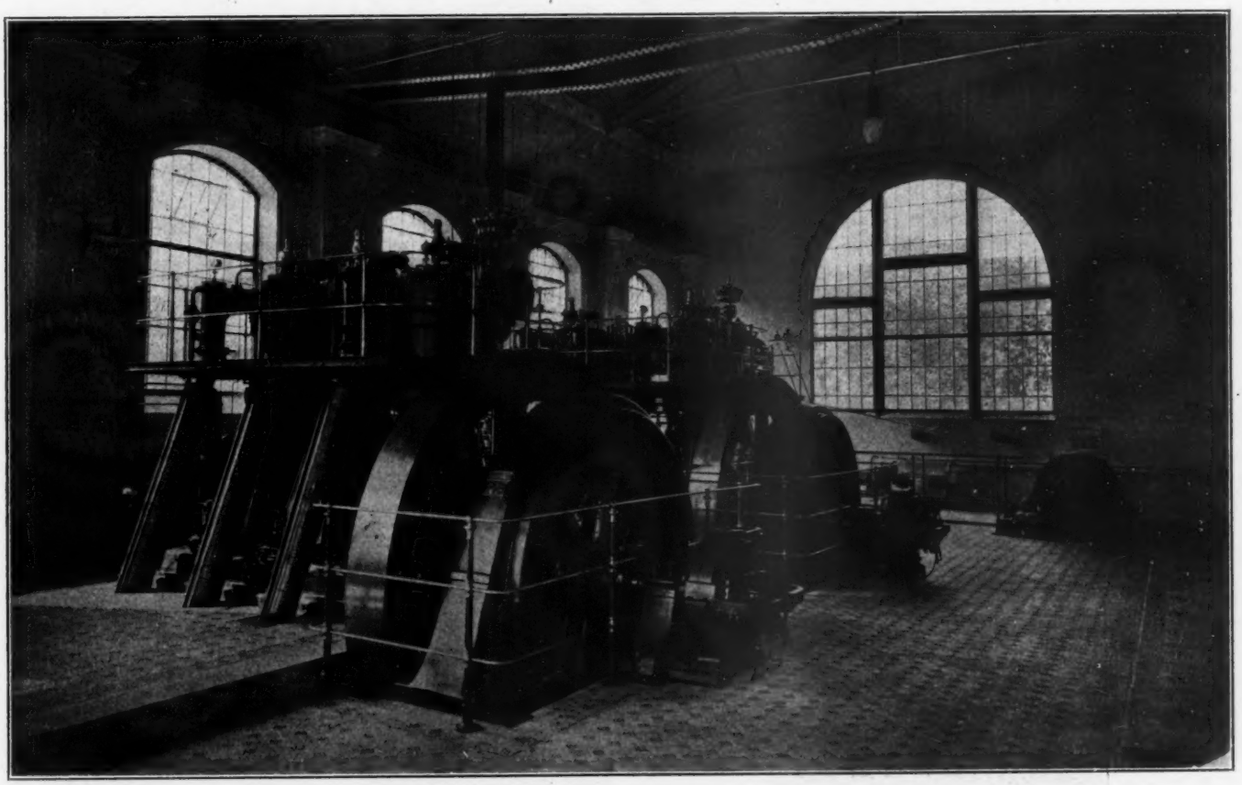


FIG. 1.—ENGINE ROOM OF IGLAU CENTRAL STATION.

The current generated at 2400 volts and 50 cycles is led by insulated conductors to the high-tension switchgear room, which

contains all the apparatus carrying high tension. This room is closed on the front by a large marble board on which are mounted the measuring instruments and switches.

From the switchgear room electricity is fed through underground cables to the mains of the town, the conversion from high to low tension being effected by a four-conductor system at a tension of 190 or 110 volts in transformer stations of which 14 have been so far installed. Nine of these stations have been located in kiosks, whereas the remainder are situated in the central station, schools, factories, etc.

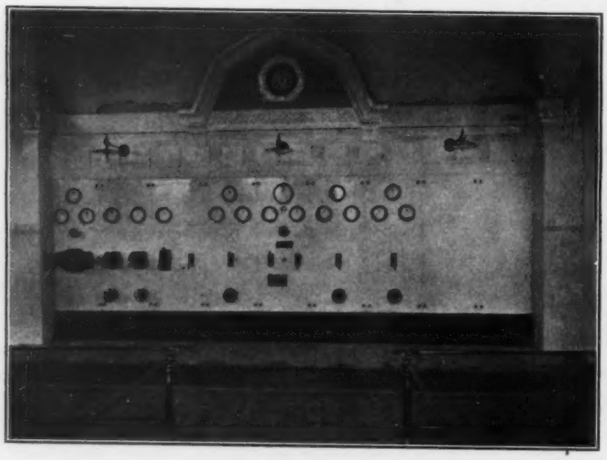


FIG. 3.—SWITCHBOARD.

Each transformer station will contain two transformers, each rated at 50 kva, only one of which has been so far installed. The stations further contain at the high-tension end cable terminals, section switches and fuses, and at the low-tension

FIG. 4.—TRANSFORMER HOUSE.

end fuses, switches and lightning arresters for the transformer as well as the station terminals of the four-conductor cables connecting the overhead conductor system to the transformer station. The junctions of the transformer with the cable terminals are carried over busbars, thus allowing a second transformer as well as a further cable connection to be readily and simply thrown into circuit.

The low-tension system consists of overhead lines carried mostly along the fronts of houses and partly on poles. The

FIG. 5.—HIGH-TENSION SWITCHGEAR ROOM.

circuits feed upward of 4000 lamps in houses, a theater installation and a number of motors. Of the latter a total of over 200 hp has been so far connected to the system. It is contemplated to connect to the system a number of factories, situated outside of the town, through special transmission lines. In order to further the small industries the municipality has purchased a number of electric motors which are leased to users on the payment of a yearly interest and final payment of the capital, so as to allow the motors, after a number of years, to become the property of the users. A similar process has also been used successfully in connection with lighting installations. The public lighting, which has so far consisted of gas lamps fed from the gas works, is to be replaced shortly by an electric system.

Low-Voltage Equipment and Control in Waterside Station No. 2 of the New York Edison Company.

As pointed out in the issue of March 25, the field rheostats of the turbo-alternators in Waterside Station No. 2 of the New York Edison Company are electrically operated from the high-tension switchboard. The rheostats are located on the exciter floor. The field switch has opening and closing magnets and discharge coil and a ¼-hp motor is used to cut in grid resistance units or vice versa. To insure an uninterrupted supply of excitation current there are four 150-kw motor-generator sets and two 500-kw motor-generator sets, together with storage batteries of 290 cells. All the generators when connected to the exciter bus have instantaneous reverse-current relays in circuit so adjusted that a reverse flow of 25 per cent full-load current into a defective generator will immediately trip the circuit-breaker and thus prevent any unusual demand on the exciter system. While it is possible, but not at all probable, that all of the motor-generator sets might become inoperative, the generator field coils could be excited from the storage batteries or from the external Edison system. Emergency reserve connections are also provided with the Metropolitan Street Railway system and with the Brooklyn Edison system. It is therefore evident that the supply of excitation current is safeguarded as far as human ingenuity can do so. All the electricity for switch control and signal systems is taken from the exciter section through widely separated feeders so that injury to one will not throw out the other.

Fig. 1 is a view looking down the exciter gallery, showing the

motor-generator sets. The 500-kw sets are used for supplying electrical energy to the lamps and motors in the station, while the smaller sets are used for excitation purposes only. The latter consist of 220-hp, 25-cycle, three-phase Westinghouse induction motors driving 250-volt shunt-wound generators. The

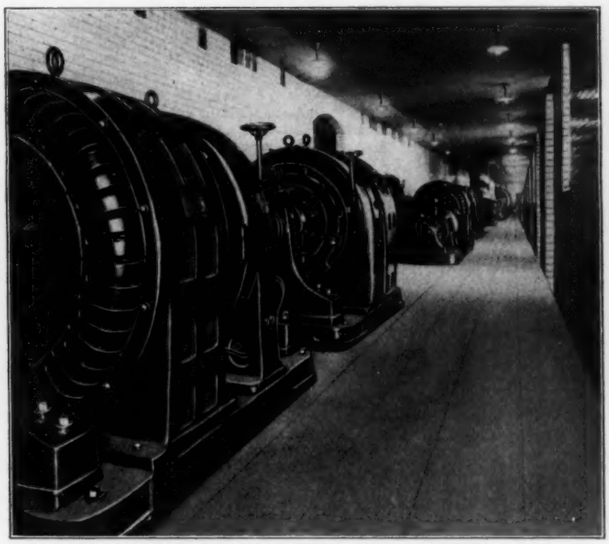


FIG. 1.—EXCITER ROOM IN WATERSIDE STATION NO. 2.

larger sets comprise 675-hp, 6300-volt, 25-cycle motors and 300-volt generators. One of the sets is of Westinghouse manufacture and the other of General Electric make. Other apparatus in this room are two booster sets, one compensator and end-cell switches. A Westinghouse booster set is made up of two

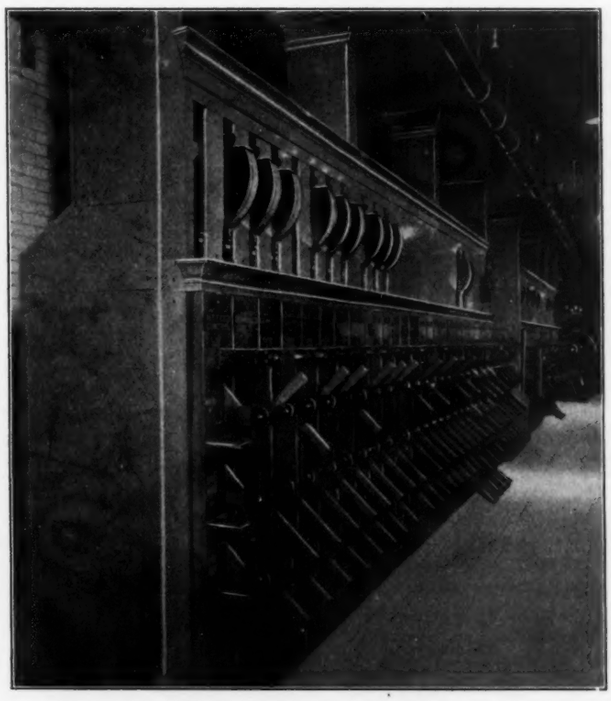


FIG. 2.—EXCITER SWITCHBOARD.

48-kw generators and one 150-hp motor. The other booster set is of Crocker-Wheeler design and consists of two 36-kw, 60-volt generators and a 110-hp, 240-volt motor. The compensator was built by the Northern Electric Company. It consists of two 75-kw, shunt-wound generators having a voltage range of from 125 volts to 150 volts and is equipped with starting rheostat with overload and underload attachment.

EXCITER BOARD.

The exciter switchboard shown in Figs. 2, 3 and 4 is of special design, although conforming with the Edison Company's

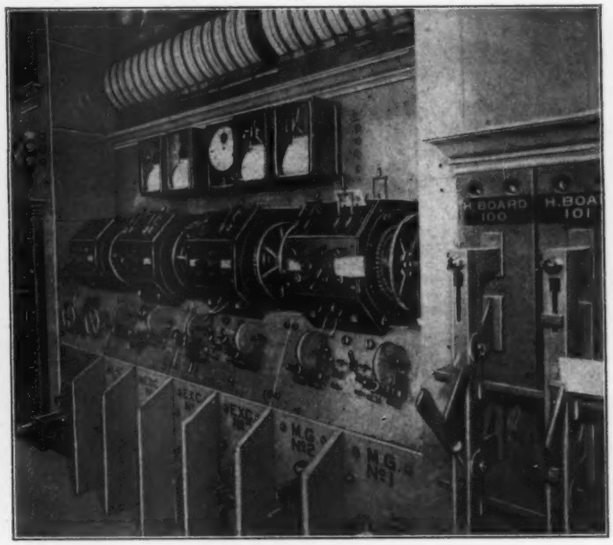


FIG. 3.—CONTROL SECTION OF EXCITER SWITCHBOARD.

standard substation switchboard practice. The positive and negative sections of the board are separated by the control section; the buses and connections of the same polarity being separated by barriers front and back. As shown in the engravings, the switches are of the Van Vleck edgewise type, possessing the advantage of economizing space. The board is tied in with the motor-generator light and power board located at the west end of the room and with the storage batteries. The two large motor-generator sets and the four exciters are controlled from the center of the starting section, as well as the end-cell switches of both batteries. There are three sets of buses on the positive and negative sides of the feeder bus section. The buses are made up of rolled copper strips separated from each other by slate barriers and are supported on the studs of the edgewise feeder switches. A complete diagram of the exciter-board connections is shown in Fig. 5. Besides the usual edgewise voltmeters and ammeters, the starting section is equipped with eight end-cell switch indicators, four for each battery; four graphic voltmeters with master clock, two on each battery circuit; four double-dial rheostat frames for supporting rheostat dials for motor-generators; interlocking starting switches for exciters and motor-generators; push-button switches for the motors operating the end-cell switches, tell-tale lamps, etc. The negative and positive sides of the board are equipped with four 2000-amp edgewise, single-circuit, battery and booster switches of special design, built for four buses. The other single-circuit switches are designed for three buses and are rated at 1200 amp. The reverse-current relays are mounted in each exciter circuit on the back of the board. The negative board has in addition four exciter circuit-breakers.

The main light and power board from which radiate all the feeders that serve the station with electricity is built similarly to the exciter board with positive and negative sections separated by the control section. This board is fed directly from the large motor-generator sets and is tied in with the exciter board, with a storage battery, with Waterside Station No. 1 and with the street network.

BATTERY EQUIPMENT.

The battery room is located under the electrical galleries on the Fortieth Street side of the station. The floor arches are topped with four layers of Hydrex and asphaltic pitch covered with concrete to a depth of 5 in. and with small piers for sup-

porting the cells. The piers are capped with sheet lead and over all the floor piers and up the side walls to a height of 6 ft. a layer of acid-proof mastic is spread. The room is drained through lead-pipe connections from a lead box embedded in the floor, and ventilated by means of a motor-driven fan through protected ducts.

three-wire system and 20 end cells. Each element is contained in a lead-lined wooden tank, supported on a double tier of insulators resting on vitrified brick laid in sulphur. The two tiers are separated by a wooden frame. The capacity of each battery is 2000 amp for one hour on each side of the three-wire system. It will thus be seen that the reserve battery capacity

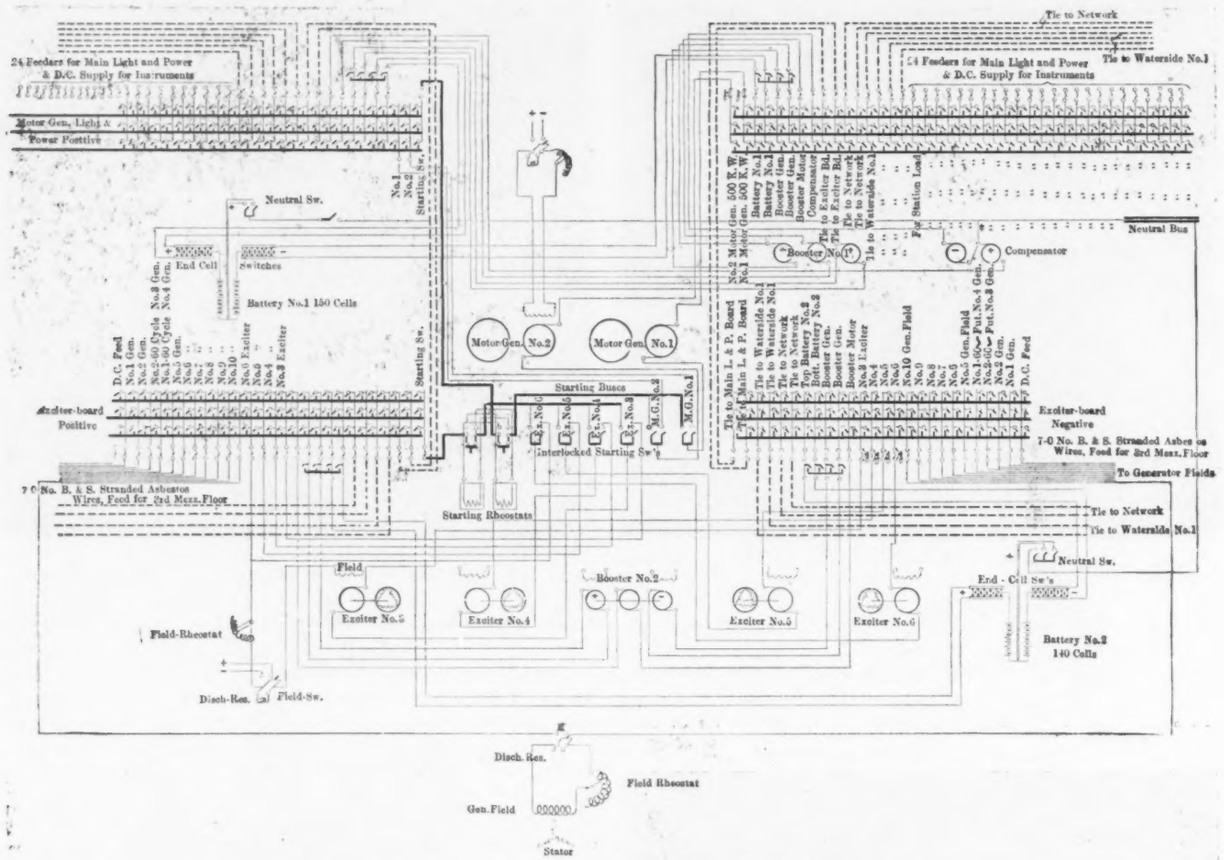


FIG. 4.—DIAGRAM OF EXCITER SWITCHBOARD CONNECTIONS.

The equipment comprises two batteries made by the Electric Storage Battery Company. Battery No. 1 has 150 cells of the R-39 type and battery No. 2 has 140 cells of the same type.

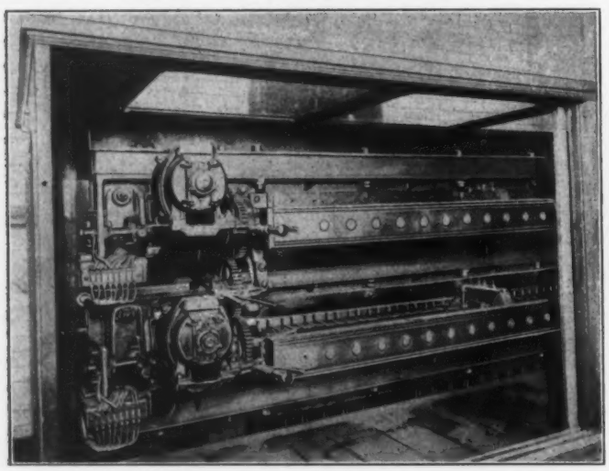


FIG. 5.—MOTOR-OPERATED END-CELL SWITCHES.

Each battery is equipped with electrically operated end-cell switches with two sliding contacts. Battery No. 1 is connected to the main light and power board and battery No. 2 is connected to the exciter board. Battery No. 1 has 75 cells in series on each side of the three-wire system, 20 of which are end cells; battery No. 2 has 70 cells in series on each side of the is 4000 amp at 270 volts or 8000 amp at 135 volts. The nominal rate of charge is 570 amp and the maximum rate 800 amp for each side of the system.

For each battery there are four 24-point regulating switches, two on each side of the system. The traveling brush is fitted with an automatic control switch and circuit opener and is motor operated, the motors being of Sprague make and rated at ⅛ hp for battery No. 1 and ½ hp for battery No. 2. These switches are located in the exciter room. (See Fig. 5.)

SIGNALING SYSTEMS.

There are two general systems of transmitting signals between the switchboard operator and the engineer at the turbine throttle. One system relates to the governing of the turbine, and consists of an illuminated sign located on the west wall of the turbine room, and used in conjunction with a signal whistle. The other system relates to the stopping and starting of the turbine, and instructions are transmitted to the engineer by means of illuminated signals located on the wall, as shown in Fig. 7, or on a stand near the turbine throttle. Means are provided in this latter system for transmitting return signals to the switchboard operator.

In addition there are three whistles of different sizes and sounds: one operating from the high-tension board, another from the direct-current switchboard and an emergency alarm whistle sounded by the system operator. These whistles are operated by means of solenoids energized from the exciter section. Fig. 6 shows the connections to the signal for regulating the governor. Single-pole, single-throw switches, located on the front of the generator pedestal, are used for operating the whistle relay and for flashing the turbine board. By means of small knife switches located under the synchroscope panel of the

turbine board a red or green panel of the illuminated sign may be flashed individually. The illuminated sign for the turbine boards and engine signals is made of sheet iron, and is set flush with the engine-room wall. The turbine numbers, 1 to 10 inclusive, are stenciled in white, and above each numeral is a

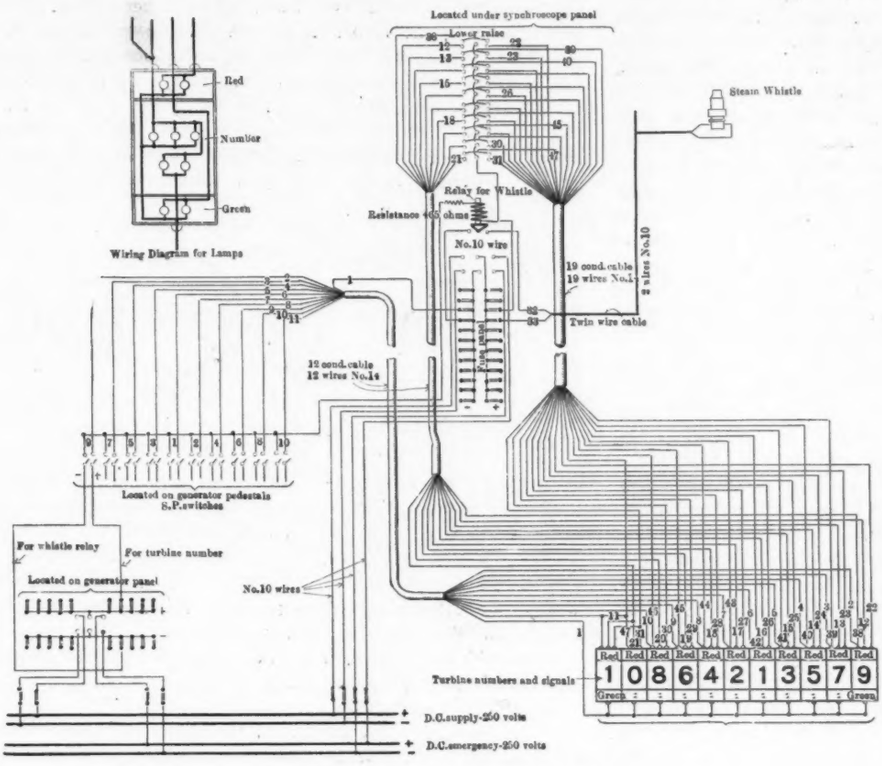


FIG. 6.—DIAGRAM OF SIGNAL CIRCUITS.

separate ground-glass panel to indicate red for "raise," and below a similar panel to indicate green for "lower." Within these sheet-iron boxes are the lamps and circuits for illuminating the turbine numbers and the signals mentioned. With this equipment the operator at the generator pedestal can blow a signal whistle and flash the turbine number, and can also blow the whistle, and flash either a red or green signal, together with the corresponding turbine number. Fig. 7 shows the signal box used to impart certain instructions to the engineer at the throttle of the turbine. Below the frequency indicator on this signal box are small, ground-glass illuminated plates containing the following legends: "Start," "Stand By," "Load Off," "Full Speed," "O. K." and "Shut Down." The signals for the Curtis turbine sets are identical with those for the Westinghouse sets, with the exception that they are mounted on stands near the turbine. For operating the call whistle there is installed on the exciter board a hand-operated oil switch.

The boiler signal system consists of an electric carriage call, used for transmitting numbers from the system operator to the foremen in the boiler room. The number flashed indicates to the foreman the number of boilers that will be required within the next 15 minutes. Working in conjunction with the carriage call is a registering time-clock, so that the signal and the time it was transmitted are automatically recorded. In addition to these systems there is a complete intercommunicating telephone system connecting the high-tension and low-tension switchboards, system operator, foremen, superintendent, substations, etc. There is also a pneumatic tube service maintained between the system operator's desk in Waterside Station No. 1 and the high-tension control board in Waterside Station No. 2. In order to insure the greatest possible safety for the workmen the system operator transmits all orders in writing. For transmitting messages between the high-tension control board and the direct-current switchboard a telautograph is employed, so that a written record is kept of all the orders passed between both switchboards.

Every precaution is taken to render communication between the system operator and the various substations by telephone reliable and instantaneous. The telephone lines to the substations are routed through two telephone exchanges. The lines and switchboards are in duplicate, and the trunks within the station are carried in separate conduits. While the company has heretofore depended entirely upon the telephone for transmitting orders between the system operator and the substations, it was appreciated that this system was too slow in cases of emergency. The Edison company has, therefore, installed a signal system similar to a fire alarm. The purpose of this system is to convey simultaneously to all of the substations signals which will reach the operator no matter in what part of the substation he may be. There is a series of 10 signal buttons connected in multiple to private telephone trunk lines. By pressing any button its signal is transmitted to all of the stations. Thus, should the system operator anticipate any trouble which would need prompt attention, all substations would be apprised of this condition at once. The distribution of all electricity from both Waterside stations is under the exclusive control of a system operator. Feeders and rotary converters are put into or out of service only on his order and he receives at frequent intervals reports from all substations, giving the load on each high-tension feeder and the reserve held in the storage batteries. Before him is a complete map of the system, including stations, substations and feeders. By means of suitable markers the system operator can tell at a

FIG. 7.—TURBINE THROTTLE AND SIGNAL BOX.

glance what feeders are connected, their routes and their loads. If a feeder or machine is held off for repairs this is indicated also.

LIGHTING AND MOTOR EQUIPMENT.

For supplying electricity for various purposes throughout the

station there are two separate and distinct systems of conduit, panel boards, etc., installed. Incandescent and arc lamps are connected to the Edison three-wire system, having a potential of 240 volts across the outside wires. The motors are connected to two-wire, 240-volt circuits. Both of these systems are supplied with electricity from the power and lighting board in the exciter room. Conduit is used throughout the installation, which conforms strictly to the requirements of the National Board of Fire Underwriters, and to the laws, rules and regulations of the Department of Water Supply, Gas and Electricity. The turbine room is lighted by means of arc lamps hung from the walls on ornate brackets, and by incandescent lamps placed upon the roof girders. The arc lamps are controlled from panel boards conveniently located on the walls of the turbine room. The girder lamps, which are rated at 8 cp, are spaced about 18 in. apart, 40 to the girder, and are controlled from a panel board on the sixth gallery. In addition, each turbine has an individual panel board for controlling the lamps mounted upon the wall near the machine, and has about 80 incandescent lamps distributed over it. These are fed through flexible conduit.

The boiler room is lighted by arc lamps hung in the main aisles opposite each passageway between boilers, and by incandescent lamps located as follows: One on a flexible arm bracket placed at the water-gage glasses, one at each steam gage and one above the boiler drums. Outlets on the working circuits are also distributed around the boilers and behind them. The boiler-house monitors and coal pockets are lighted by incandescent lamps, together with arc lamps hung over the coal pockets and controlled from panel boards located on that floor. The battery room is lighted from special four-lamp clusters, fitted with enameled sheet-iron shades hung from the arches by loricated tubing. The electrical galleries, offices, stairs, etc., are lighted throughout by incandescent lamps.

Arc lamps are hung on the outside of the coal tower at each corner, and on outriggers over the water sufficiently long to hold the lamp over the middle of a coal barge moored to the wharf. A number of arc lamps and incandescent lamps are distributed in the coal tower and around the various engines and motors. Incandescent lamps are also mounted on the boom overhanging the river. These are guarded and shaded so that the light from them shall not shine into the eyes of the operator in the tower above, but be directed downward to the traveling bucket.

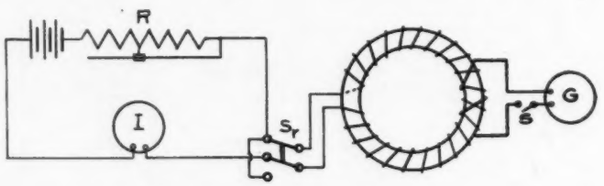
In addition to the motors already mentioned in previous articles, electric motors are used for passenger elevators, machine-shop tools and for driving the large cranes which span the turbine room. The latter are rated at 50 tons and 75 tons, respectively. The 50-ton crane was built by the Shaw Electric Crane Company. The main hoist is capable of lifting 50 tons and the auxiliary hoist 5 tons. The main-hoist motor is rated at 65 hp, the auxiliary motor at 22 hp, the trolley motor at 7½ hp and the bridge motor at 22 hp. The controllers are placed in the rear of the operator's cage, and the levers are brought in front of the operator. Each hoist has an automatic limit switch, which prevents over-travel of the lower block in the hoist. In addition there is provided a load brake, which is applied by the weight of the load, and released by the rotation of the motor in a lowering direction; and a motor brake, which is released by the current which operates the motor, and applied by gravity when the circuit is interrupted. The crane, built by the Case Manufacturing Company, is rated at 75 tons, and is equipped with General Electric motors of the dust-proof series reversible type. The main-hoist motor is rated at 75 hp, the auxiliary hoist at 30 hp, the trolley hoist at 15 hp and the bridge motor at 50 hp. The crane is provided with all of the customary safeguards.

There are three passenger elevators in operation, which are of the Otis Company's electric type. Two are located in the boiler house and the other in the elevator and stair shaft at the Fortieth Street and First Avenue corner. The latter is intended for general passenger service and is capable of lifting 2500 lb. at 300 ft. per minute. The other two are intended primarily for freight service and can lift 4500 lb. at a speed of 200 ft. per minute.

Calibration of a Ballistic Galvanometer.

By C. M. Jansky.

In one of the late "Handbooks for Electrical Engineers" there is given under the subject "Magnetic Testing of Iron" the equation $B = 10^8 K r \theta \div 2 a n$, in lines per square centimeter, r being the resistance of the ballistic galvanometer, θ the throw and K the constant of the galvanometer; the number of turns on the exploring or secondary coil is n and the cross-sectional area of the iron ring is a. Fig. 1, taken from the handbook, shows the connections for this experiment, which are well known. The author states that $K = C e \div (\theta' 10^6)$, where C is the capacity in microfarads of the condenser, e the e.m.f. in volts to which the condenser is charged, and θ' the throw of the galvanometer. In another handbook for electrical engineers are given the same directions for testing the magnetic properties of iron by the ring method.



CONNECTIONS FOR TESTS WITH A GALVANOMETER.

It is the purpose of the present article to point out the fallacy of this method for determining the constant K. Results obtained in this way, though consistent, are not the correct values. The reason for the inaccuracy lies in the fact that the conditions under which the galvanometer is used are not the same in the two cases.

In determining the constant K, the circuit consists of the galvanometer and condenser, and the galvanometer behaves as if it were on open circuit. In the other case the galvanometer is closed through a circuit of low resistance in most cases, and the oscillations of the galvanometer coil are greatly damped by the induced current produced by the coil swinging in the magnetic field. The smaller the resistance the greater the damping.

There is nothing new in this statement of the problem, yet the fact that the two handbooks give wrong directions seems to indicate that a wider knowledge of the principles involved is necessary.

Mr. David Robertson[1] showed that if a secondary coil of n turns be connected in series with a galvanometer whose resistance is G, Q, the quantity of electricity, may be expressed in the form $Q = (N n - q d) \div (R + G)$, where N is the change in the number of lines linked with the search coil, d is the deflection of the galvanometer, and q is the product of the number of lines cut by the galvanometer coil and the number of turns which cut them when the deflection is unity. K is the ballistic constant of the galvanometer determined in accordance with the equation $Q = K d$.

Solving for $N n$,

$$N n = K (R + G) d + q d$$
$$= K \left(R + G + \frac{q}{K} \right) d$$

This expression shows that the correct value of $N n$ is not obtained when $\frac{q}{K}$ is neglected. The correction $\frac{q}{K}$ may be considered as an addition to the resistance of the galvanometer and the apparent resistance of the galvanometer is $G' = G + \frac{q}{K}$. This apparent resistance may readily be found by observing the deflection of the galvanometer when only the search coil is in the circuit, and then introducing sufficient resistance to reduce the deflection one-half.

[1]David Robertson, London *Electrician*. Vol. 19, p. 901.

In the first case

$$N n = K \left(R_1 + G + \frac{q}{K} \right) d_1$$

In the second case

$$N n = K \left(R_2 + R_1 + G + \frac{q}{K} \right) \tfrac{1}{2} d_1$$

Then

$$R_1 + G + \frac{q}{K} = \tfrac{1}{2} \left(R_2 + R_1 + G + \frac{q}{K} \right)$$

$$R_2 = R_1 + G + \frac{q}{K}$$

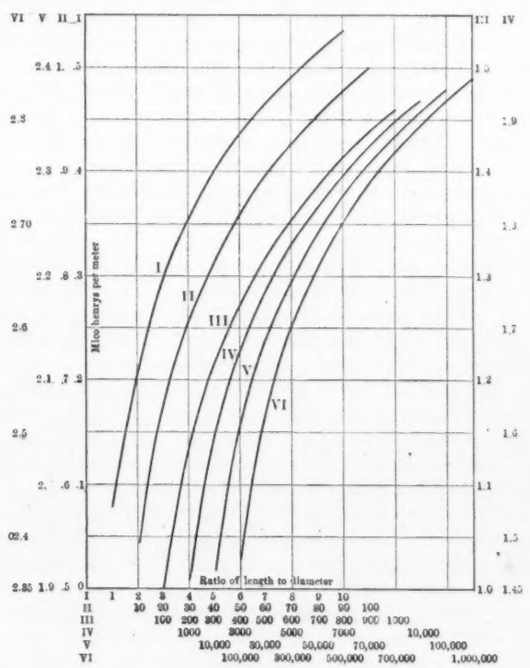
By using this value for the resistance of the galvanometer circuit the constant K as determined by the condenser method may be used.

Results obtained by the above method may differ from results obtained when the galvanometer is calibrated by means of a standard coil by as much as 10 to 15 per cent.

The Inductance of a Straight Wire.

By G. E. Marsh.

In either the practical or experimental application of Hertzian waves, the determination of the inductance of a circuit, or a part of it, is a frequent problem. When the case is that of the Hertz dumb-bell or open-linear type the inductance is constituted by the rod joining the balls or plates and interrupted at the spark-gap. The capacity of the circuit, possessed mainly through the presence of the balls or other expansions of the conductor, can be calculated by means of simple formulas.



INDUCTANCE CURVES.

The inductance of the rod portion is given in microhenrys per meter by the expression $\frac{2l}{1000} \left\{ 2.303 \log_{10} \frac{4l}{d} - 1 \right\}$ where l and d are in centimeters.

The accompanying curves permit the inductance of a straight circular-section conductor to be quickly ascertained. When using a Hertz or similar oscillator for generating electromagnetic waves, the capacity, inductance and wave-length can be computed in a few seconds. The length of the emitted wave can be most conveniently found by means of the diagram described by Mr. W. W. Massie in the *Electrical World* for Aug. 18, 1906.

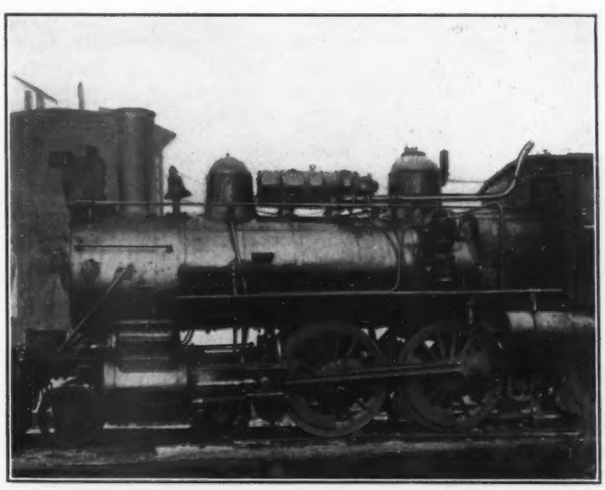
To illustrate the application of the curves let it be desired to find the inductance of a wire 3 m long and 0.4 mm in diameter. The value of l/d in this case is $\frac{300}{0.4} = 750$. Taking 750 as the abscissa, found in line III, moving upward until curve III is intercepted and then proceeding to the columns III, on the right, the inductance is found to be 1.4 microhenrys per meter, and hence giving a total value of three times 1.4, or 4.2 microhenrys.

In general, it is in the field of wireless telegraphy that the determination of the inductance of a single wire is required, but the curves are applicable to any straight portion of a circuit that is far removed from the part carrying the return current.

Train Lighting at 110 Volts by Turbo-Generator on Locomotive.

Suburban train operation, differing from through train operation in that there is no changing of locomotives and rarely of cars from one end of the run to the other, offers exceptional opportunity for simplicity in electric train lighting. This fact is amply demonstrated by the new equipment adopted as standard by the Chicago, Burlington & Quincy Railroad in its suburban service out of Chicago. The arrangement has been tried on one train making a regular daily run in the evening from Chicago to Aurora, a distance of about 40 miles. It consists simply in placing a turbo-generator on the locomotive with electrical connections to the cars.

The accompanying picture shows the generating set mounted on a locomotive with the dynamo end toward the smokestack. The generating outfit is rated at 20 kw and consists of a horizontal Curtis steam turbine directly-coupled to a two-pole, 110-volt direct-current dynamo. The whole unit is ironclad, the covers being clamped in with gaskets, so that it is stormproof. Steam is taken at the locomotive boiler pressure on different classes of engines, running from 140 lb. to 180 lb., the variation being entirely taken care of by the governor. The turbine turns at



TURBO-GENERATOR ON LOCOMOTIVE BOILER.

4500 r.p.m. The whole unit is 5 ft. 6 in. long, 2 ft. 8 in. high and 1 ft. 11 in. wide. It weighs 2300 lb. and is securely bolted on top of the shell of the locomotive boiler, as shown

There is a marble panel in the cab of the locomotive on which are mounted a voltmeter and a rheostat. Ordinarily all the attention that is needed to operate the train-lighting set is for the fireman to open the steam valve when he wishes to put the turbine in operation and close it when the run is over, but should the number of cars in the train vary (although this is ordinarily not the case) the difference in resistance on the dynamo circuit, as indicated on the voltmeter, is met by manipulating the rheostat.

From this locomotive unit nine standard suburban passenger coaches are lighted and also the headlight and lamps in the

locomotive cab. The locomotive headlight is a 50-cp carbon-filament stereopticon lamp, arranged with the usual reflector, and is said to give six times as much light as the oil lamp which is usually used on suburban service. In the cab there are four electric lamps arranged to illuminate the gages or placed on lamp cord so that they may be used anywhere about the cab or in the tender if needed.

The lamps used throughout for car lighting are rated at 16 cp. There are nine cars, as stated, and each one has 21 lamps. Four of these are on the platforms, one is in the toilet room and 16 are placed in the body of the car underneath the deck sash. These lamps are staggered down the length of the car so as to get the best distribution of light. The car has an enameled ceiling, old ivory in color, and this, of course, helps the illumination.

The circuit from the dynamo is led down and back to the rear of the tender where a straight Gibbs connector is applied, and these connectors are used throughout the train length. There are no steam connections between cars and no storage batteries so that the system is simplicity itself. Entire reliance is placed on the electric lighting outfit, and no other means of illumination are provided. Of course, the lighting unit on the locomotive makes some demand on the boiler, but in practical operation the firemen say that they can see no difference in firing a locomotive which has the lighting set on it and one which is not so equipped.

Of course, this system could not be used without modification if it were necessary to detach the locomotive from the train, but for suburban service it seems to be particularly well adapted because it is compact, out of the way and requires almost no attention. The oil cups on the turbo-generator are large, and it is not necessary to fill them more than once a week.

Mr. C. B. Young, mechanical engineer of the Chicago, Burlington & Quincy Railroad Company, has made a study of the train-lighting problem, and the present equipment represents his idea of the best and simplest system for suburban service. He is in favor of the commercial 110-volt system because lower voltages mean special equipment. Practical railroad men appear to be greatly pleased with the system which the "Burlington" has adopted as standard for all its suburban trains, and 15 additional equipments have been ordered.

This scheme of lighting trains by electricity without storage batteries and with the dynamo mounted on top of the locomotive boiler is a step toward straight dynamo lighting of railroad trains, and as such is worthy of the careful attention of railroad officers in the opinion of the "Burlington" officials.

The Patent Situation.

By Gorham Crosby.

The article by Mr. James T. Barkelew, on a phase of the patent situation, in your issue of March 18 gives rise in the writer's mind to several criticisms. It would appear from Mr. Barkelew's article that the commercial and general interests of the United States are suffering greatly because of much-needed legislation relating to patents. Although there is always chance for improvement, and it cannot be doubted this may be true with respect to the patent laws of the United States to-day, nevertheless our present patent laws do not work any such injury to the interests of the public as would appear from Mr. Barkelew's statements.

Concerning the statement of the principles of patent law, the writer has no comment to make. It is true that the benefit enjoyed by the public for its consideration to forbear for a definite length of time from interference with the inventor and his invention is the right to use the invention at the end of the period of protection given the inventor. It is also true that the present system does not take into account what the inventor does with his invention during the period of monopoly, and that a large majority of patents issued are left in a state of inactivity. The article would make it appear that these patents are a great hindrance, and form stumbling-blocks for the future inventor who endeavors to make improvements along certain lines in which these inactive patents have been granted. Although this may be so in a very few cases, it is not so to an extent sufficient to warrant the changing of the patent law for this purpose merely. An extremely large number of these inactive patents contain only claims which are so narrow that any skilful mechanic could devise an apparatus which would give to the public substantially the same advantages without infringing the claims of the patent or becoming liable in any way to the patentee. That is, of all the inactive patents which the article represents as standing in the way of future progress, only the smallest percentage are so drawn, or of such a nature, that they can prevent or hinder in any way the legitimate investigator from going ahead with his work and reaping the same profits therefrom as if these inactive patents were not in existence.

It would appear from Mr. Barkelew's article that he proposes some sort of legislation whereby these inactive patents could be made void, so that the public could manufacture and operate under it, and derive the consequent benefits without the payment of royalties. And yet he says there is not sufficient available capital to exploit all of these patents, and that there is an economic limit to the speed at which changes may take place, this limit being at the point where the cost of the change entirely offsets the benefit accruing therefrom. What then would be the advantage to the public of having these patents made void, if, after they were open to all, there is not enough capital to exploit them, or if the cost of making the changes to bring them into practice is wholly unwarranted for economic reasons? To take the patentee's rights away from him under these conditions is to deprive him of something which he might just as well maintain. Why not then let the patentee retain his rights until the public does desire his improvements, or until capital is forthcoming with which to exploit them? When the public desires the use of the patentee's improvements it will be glad to pay him for them, and until such time the patent had better be idle in the patentee's hands than to be made void when no one wants to use it, thereby depriving the patentee ever afterward of receiving any profit from his probably meritorious invention.

The article states that this economic reason is probably the real one for the inactivity of the large majority of patented devices. If this is the reason, how is any change in the patent law going to avoid the inactivity of these patents? If the patentee is forced to work his invention when the public and the progress of the art to which it belongs do not warrant it, it is simply placing an additional burden upon the inventor without anyone deriving any advantage therefrom. It is, it would seem, the purest fallacy to require an inventor or patentee to manufacture or work his invention when the public or the state of the art does not need it. In substantially every case the inventor, patentee or assignee will be glad to work his invention when the proper time comes, when there is an opening in the market for it and capital is forthcoming.

The contention that a stray inventor may obtain a hold on an art in which he has no real right and standing, as compared with inventors and patentees who make practical inventions and put them into practical use, is, I believe, greatly exaggerated. If the application of the stray inventor is supported by a device which is crude, or which is inherently wrong in the construction of a valuable part, the courts are quick to take notice of this fact and see that it does not improperly restrain the public from utilizing the improvements of a more meritorious inventor. The decisions of the court are many in which patents supported by crude and inoperative devices have been held not infringed by meritorious machines, although the original patent had many broad claims.

It is not clear how the public has any large amount of wealth tied up without receiving any returns because of such practice. The fact that the inventor is greatly dependent upon the public for the working out of his inventions is no argument why he should be deprived of his right to receive profit from his labors. The public is more than repaid for the grant of monopoly by

the free use of the invention which it may have at the expiration of the term of the patent. If the invention is one which cannot be put into commercial use for economic reasons, or because of lack of available capital, this is just so much loss to the patentee, and so much gain to the public, since the actual time during which the monopoly may be active is just so much shortened. The patent grant is not given to the inventor unconditionally, since he is required to give his invention to the public at the expiration of the term of the patent; and if there are several inventors, the most equitable and practical way is to give the monopoly to the one who first diligently places the invention before the public in the form of an application for a patent.

It is believed by many that the great commercial activity of the United States is due largely to the liberal patent laws of this country. The more burdens placed upon the inventor and patentee the less is the incentive to the creative mind to work out improvements which will be of value. The United States Government needs no taxes, since the present fees required of the inventor in obtaining a patent have proved amply sufficient to support the Patent Office and to pay all expenses incurred in connection therewith. To place the burden upon the inventor to work his invention when it is not desired by the public, or when there is not sufficient capital to put it into commercial use, is simply to place upon the inventor a tax in another form, a tax which is more burdensome than any of the monetary taxes now imposed by foreign nations. What good can the public derive from the device covered by the patent being manufactured or worked in any way, when the public does not desire the device, and when there is not enough capital available to properly put it on the market? Absolutely none.

The article argues that because Great Britain and other countries have made patent laws which require a working of the invention after a short period of time, that the United States should also do so in order that foreign inventors in taking out patents in this country may not have an advantage over American inventors taking out patents abroad. Can it be possible that we should cut our own throats in order that we may get back at the foreign patent laws because they are not favorable to us? Certainly not. The comparatively few United States patents issued to residents of foreign countries form no ground for this. We cannot see how the issuance of these patents to foreign inventors means the signing away of any wealth without any prospect of returns, whether or not they are issued for impracticable machines. If they are issued for impracticable machines, they in no way hinder the progress of the art here; and if they are for practical, valuable machines, they will in due time be worked here when the public desires it.

While our own inventors may be placed in what may appear an inferior position by granting rights to foreign inventors to which the advantages enjoyed by our inventors in other countries are not equal, nevertheless, this is no excuse for hampering our own progress. Since out of the large number of inactive patents in this country there are so few which in any way hinder the commercial progress here, and since the imposing of further taxation or compulsory working, or both, only tends to further burden the inventor or his assignee without increasing the advantages to the public, there is no cause to make any change in our present system on the grounds stated. The provision of a law compelling the payment of taxes or compulsory working, or both, would no doubt mean the voiding of a large number of patents here; and aside from the burdens concurrent therewith, this action would further deaden the stimulus for invention by putting before the inventor the proposition that unless he was in the beginning financially well backed, he would probably lose his entire rights before ample opportunity had been provided to put his invention on a commercial footing.

Of all the burdens placed upon patentees in foreign countries, perhaps the one forbidding importation could be best exercised here without doing material damage. At least the laws here should not provide for any greater incumbrance upon the patentee than to require him to give a license in case he refuses to manufacture himself, when the public demands the invention. If there were any great number of idle patents which were hindering future progress, the most we would suggest would be to change the laws so that any party who desired to use the invention could obtain a license, in case the patentee refused to manufacture at all. The burden of obtaining such a license should be placed upon the party desiring it, and should only be granted after the wilful refusal of the patentee to grant one under reasonable terms.

We think such controversies could be well taken care of in the present Federal Courts, or possibly in a Court of Patent Appeals, which has recently been suggested as a court of final resort for all patent cases.

We believe that substantially the only case in which an idle patent hinders the progress of commercial arts is when corporations obtain control of patents covering devices similar to their own manufacture for the purpose of preventing others from manufacturing competing devices with their own. Such cases, however, are so few that a law designed to prevent these wealthy corporations from doing this would so much burden the poor inventors that more harm than good would result therefrom.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Electric Irons in Salt Lake City.

Mr. B. W. Mendenhall, commercial agent of the Utah Light & Railway Company, of Salt Lake City, reports as to his company's flatiron campaign for 1907 and 1908 that his company purchased 4000 Pacific irons during those two years. Of this number 751 were on hand Jan. 1, 1909. During the two years 62 defective irons had been replaced under the one-year guarantee. Irons in service Jan. 1, 1909, were therefore 3187. Of this number 1560 were put in service during 1907 and 1627 in 1908. The irons defective have been less than 2 per cent of the total number in service. These irons have always been sold subject to a 30-day trial, whether paid for in cash or billed at the expiration of the trial period. The last seven months of 1908 the records show the following: Number of irons put out on trial, 942; number of irons sold for cash, 256; total number of irons put out, 1198; number of irons returned, 66; per cent of irons returned, 5.5. The large number of the irons returned were returned because the parties could not pay for them, were leaving town, had no use for the iron and various other reasons.

A Remarkable Flatiron Campaign.

From Dec. 15 to March 15 the contract department of the Commonwealth Edison Company, Chicago, distributed 10,000 electric flatirons to its customers. Deducting Sundays, holidays and half-holidays from this three-month period there remain 68½ working days, giving an average of 146 irons put out daily. These figures constitute a remarkable record for the Commonwealth company.

The irons were delivered by special flatiron solicitors and demonstrators, who attached them and explained their use, showing the proper way to regulate the heat, the most convenient way to attach the cord, and especially calling the attention of the customer to the advisability of using the irons

in the daytime while the lamps were not being used in order to prevent, as much as possible, affecting the maximum demand.

All irons were delivered under a six-months' loan plan. The subscriber signed a card requesting the delivery of an electric flatiron, to be loaned by the company for a period of not less than six months. There is no rental charge for the iron, and the subscriber agrees to use it regularly on the company's service. The subscriber also agrees to be responsible for the iron and agrees to return it upon demand if he should cease to have a regular use for it, or if he should vacate the premises in which it was installed.

The flatirons were delivered mostly to houses and apartments, although a few were placed in stores. The company is now using the same force of men for the purpose of calling upon the customers who have received these irons to inspect them, and at the same time to care for any complaints or repairs.

A very complete and systematic organization was effected by Mr. George B. Johnson, of the contract department, to handle this flatiron campaign. On an average 20 men solicitors were employed. These were divided into "crews," consisting of a captain and four others. The captains reported to a supervisor, who, in turn, reported to Mr. Johnson. Commissions were paid, based both on orders and on demonstrations. The city was divided into routes, and an exhaustive system of records was established and kept. Three delivery wagons, each capable of holding 75 irons, were kept busy, and these were supplemented by two buggies in the later stage of the campaign.

While the flatiron solicitors were making their rounds they received orders for other electrical apparatus or took steps to remedy any causes of complaint that might be found. The irons put out are all new, and each was stamped with a different number by the Commonwealth Edison Company for purposes of identification. The introduction of 10,000 flatirons has been accomplished most satisfactorily, and it now remains to watch the effect of this additional day load on the company's mains and to make permanent arrangements with subscribers as to ownership of the irons.

Advertising Electricity.

By William Plattner.

Judicious advertising is judicious publicity. Advertising, rightly done, will cause customers to have confidence in the electric light company and increase the sale of electricity by bringing in new customers and teaching the old ones the new appliances. Advertising that creates confidence may be termed policy advertising.

The square deal is a policy that every electric light company would do well to adopt, and this is given when a representative of an electric light company is frank, fair, open-and-above-board, and pleasing and gracious in manner; when he takes great pains to enlighten and not to deceive or excite a customer. Confidence is engendered in the customer when the electric light company's manager looks at the subject under discussion from the customer's point of view and is conciliatory in correspondence. A letter rightly worded wins friends for the electric light company and is good policy advertising.

Even the disagreeable duty of shutting off the electric current and taking out the meter for non-payment may be utilized in advertising to further the policy of the company. It may be good judgment to carry the idea one more step, and when the man goes to disconnect a customer and remove the meter, he should leave a neatly printed card which will state that the electric light company regrets having to discontinue the service on account of non-payment of an electric light bill, and hopes that the customer will soon be enabled to pay up and have the service continued and the meter reinstalled.

Intelligent, careful and pleasant workmen advertise in an excellent manner the policy of the electric light company. The electric light or power bill goes from the company once a month, and the delivery and payment of the same often constitutes the only connection between the two, year in and year out. Is it any wonder that the electric light and power company is often misunderstood? When the electric light and power company fails to tell and tell again its policy and its methods, some enemy of the company does the work. A progressive electric light and power company talks to its customers every day through the local daily paper.

Local newspaper advertising is, in the writer's opinion, the very best method of reaching the people quickly, effectively and economically. The electric light and power company should follow after the manner of the paper. Tell one thing each day, tell something new each day; never let the same advertisement appear in the same make-up more than once. A good plan is to run a policy advertisement one day, and an electrical appliance, heating and cooking or motor advertisement the next day.

An electric light and power company that gives the people a square deal, regards reasonable public demands, and hammers these facts into the public's head, day in and day out, through its employees and the local newspaper, has little fear from inimical legislation, and its days should be long and golden—so should its nights.

Estimating Monthly Demand from Experience.

The number of small customers of the Commonwealth Edison Company, of Chicago, has in recent years become so large that it has been possible to estimate quite accurately the average relation between the maximum and connected load of this class of consumers, and in consequence to discontinue the use of maximum-demand meters in this service. Accordingly a notice has been issued to customers having installations of less than the equivalent of 20 lamps of 50 watts each, as follows:

"Notice is hereby given that the use of the company's maximum-demand meter now installed in your premises will be discontinued, and that hereafter your monthly maximum demand will be otherwise fixed as provided in the city ordinance governing the company's rates. The maximum-demand meter will be shortly removed from your premises."

The relation above referred to, from which the following table was derived, was obtained by making a careful study of the records of some 25,000 customers by classifying them according to the kind of business and number of lamps connected and comparing the connected load with the maximum for the different months of the year as recorded by the Wright maximum-demand meter readings:

Number of 50-watt lamps connected, or their equivalent.	Kw-hour at full rate per month.		Corresponding maximum in 50-watt lamps.	
	Commercial customers.	Residence customers.	Commercial customers.	Residence customers.
6	9	8	$6.00	$5.33
7	10	9	6.66	6.00
8	11	10	7.33	6.66
9	12	10	8.00	6.66
10	13	11	8.66	7.33
11	14	11	9.33	7.33
12	13	12	10.00	8.00
13	16	12	10.66	8.00
14	17	13	11.33	8.66
15	18	13	12.00	8.66
16	19	14	12.66	9.33
17	20	14	13.33	9.33
18	21	15	14.00	10.00
19	22	15	14.66	10.00

As the table "kw-hour at full rate per month" was worked out for the benefit of the bill clerks, and as it does not show the relation between the maximum and connected, the second table, "Corresponding maximum in 50-watt lamps," was added for the benefit of those to whom this relation may be useful. The former is obtained from the latter by reducing the maximum to kilowatts and multiplying by 30 hours' use of the maximum per month. For customers having five lamps or less the connected load is used for the maximum.

In making the count of the customer's installation, only the lamps are included and, therefore, the current used by flatirons and other heating appliances is included in the low-rate portion of the bill, which is figured at 7 cents per kw-hour. This method also has other advantages in that it eliminates the objection of some customers to having so many meters installed, and also the complaints of other customers of the great varia-

tions from month to month in the primary portion of their bill, due usually to some social affair that occurred only one night in the month. Another advantage is the saving of the investment in demand meters, and the cost of reading and caring for them for a large number of small customers.

Central-Station Handbook.

The Commonwealth Edison Company has issued in attractive form for the benefit of its customers a handbook setting forth the method and requirements of the company for supplying electric current for light, heat and power. The information contained is based upon the questions most frequently asked of the company's employees, together with such information as may be of interest to those using or desiring to use electricity for lighting, heating and power purposes.

ILLUSTRATIONS FROM CENTRAL-STATION HANDBOOK.

Instructions are given as to the manner and form of application for service, together with hints concerning arrangements to make with contractors and for securing a city permit for an installation, etc. Following are given rates for service, together with a simple explanation of the maximum-demand system. The next section is devoted to the reading of meters, several types of which are illustrated. The reader is then informed as to the method of figuring bills, a specimen of a light and of a power bill being given. Information follows as to different classes of incandescent lamps, including special types. Attention is called to the repair department maintained by the company for the benefit of its customers, and of its shops for repair work on electrical apparatus. The concluding section is devoted to electric heating and cooking appliances, which is handsomely illustrated. Several of the illustrations of the handbook are reproduced herewith.

Automobile Charging in New Jersey.

By William H. Stuart.

Electric automobiles in New Jersey are far outnumbered by gasoline machines. The reason for this is attributable to the hilly nature of the country, especially in the northern part of the State, and also to the fact that the sale of electric cars has not been pushed to the same extent as those driven by other means. The Public Service Corporation of New Jersey has endeavored at various times to stimulate interest in electric machines by the installation of charging stations throughout the territory covered by it. In Jersey City some years ago a 10-hp motor-generator set was installed in one of the largest garages. Electricity at a potential of 500 volts was sold to operate this set at a net rate of 7½ cents per kw-hour. The average monthly consumption of this equipment was 400 kw-hours. The highest consumption was recorded during the summer months and the lowest during the winter season. The effort to introduce electric machines in Jersey City was unsuccessful and the company removed the generator set to Orange, a wealthy suburban town. In Jersey City those persons owning electric machines are charging them at their own residences, energy being used from a mercury rectifier and purchased at the rate of 10 cents per kw-hour, less a discount for consumption, regulated by the maximum demand. There are quite a number of electric vehicles in Jersey City that are charged in this manner. One consumer who has a mercury-rectifier equipment for automobile charging has his installation rated at 4 hp and it is fed from the company's lines on the maximum-demand power rate. The service supplied this consumer is alternating current at 208 volts. The average monthly maximum demand of this installation as recorded by a Wright demand meter is 1½ kw. The monthly energy consumption for the past 12 months is as follows:

1908.	Kw-hours.	1908.	Kw-hours.
April	141	November	195
May	150	December	153
June	171	1909.	
July	103	January	137
August	134	February	176
September	137	March	150
October	168		

The average monthly consumption of this consumer is 151 kw-hours, which under the rate would make the average monthly bill $8.31.

In the Orange division of the company, a territory which comprises four or five small towns, forming one of the most beautiful suburban residential districts in the country, there are about 10 automobile garages. Of these only four are equipped for charging electric machines. The largest and principal garage is located on Main Street, near Halstead Street, and has accommodations for about 100 cars. This garage charges electric automobiles at a rate of 10 cents per kw-hour. The price for charging a 12-cell battery car is about 75 cents to 80 cents, and as the average car carries a 12-cell battery the price is a fair estimate for the cost of charging an electric machine. This garage has a monthly flat rate of $25 per car, which includes charging the batteries, cleaning, washing and the general overhauling of the cars, such as oiling, small repairs, etc. There is an additional charge of $10 per month made if the car is to be delivered to the owner's address when needed and called for when the user is through with it. This brings the cost of operating an electric car, with no bother or trouble, to $35 per month. The electric-light company sells the energy to the garage at its regular power rate of 10 cents per kw-hour, with discounts based on consumption and governed by the maximum demand. The average price paid on this rate is about 6 cents per kw-hour. There are quite a few persons using electric cars who do their own charging with the aid of a mercury-rectifier outfit. The service supplied by the company is 220

volts, alternating current. In Orange the electric automobile is under the handicap of hilly roads. A great many of the streets are nothing but a succession of hills and dales which, of course, goes to increase the amount of power required for the operation of automobiles. The company in this territory will not make any decided changes in regard to the charging of electric automobiles and will conduct its work as at present for some time to come.

In Newark, while there are more electric cars than elsewhere throughout the State, there has not been until recently a garage equipped to charge these machines. Most of the garages and automobile salesrooms in Newark are located along Halsey Street, south of Broad Street. In the midst of this automobile neighborhood the Electrical Maintenance Company, of Newark, has opened a testing shop and charging station at 286 Halsey Street. The method of charging is to have the cars brought into a garage adjoining and connections made there for electric supply. A flat rate per car is made based on the size of the car. This charging station has only been in operation for a short time and has proved a success. Electricity is used through a motor-generator set. In Newark there are quite a number of mercury rectifiers on residential circuits. The average energy consumption per month for these installations is about 170 kw-hours. It is expected that before summer the local automobile salespeople will make a special effort to increase the sale of the electric machines. Every year there has been an increase in the number of cars sold and used. The electric light company is ready to help, by the introduction of charging outfits and special rates, as soon as the business warrants its doing so.

There are two other places where electricity is supplied by the Public Service Company for charging purposes: one is Elizabeth, where there are three garages with electric charging equipments. The largest garage has a 6-hp motor-generator set. The average monthly net bill, after the discounts on the power schedule are allowed, is about $10. There are also quite a few private charging equipments in the city to which energy is supplied at the regular power rates. Elizabeth has more electric machines than in any other city in New Jersey except Newark. Englewood possesses only one garage that can charge electric machines.

While so far the electric machine seems not to be in favor throughout the State, it can be made popular. Every city and town has electric service so that batteries may be charged, and the Public Service Corporation is ready to place in commission throughout its entire system all the advantages that a large and complete central-station system affords, to meet the needs and requirements of electric automobiles should their number increase to any extent.

Relation of the Central Station to the Automobile Business.

At the electric vehicle smoker, held in Chicago on the evening of March 31, Mr. E. W. Lloyd, general contract agent for the Commonwealth Edison Company, presented a short paper on "The Relation of the Central Station to the Automobile Business." The speaker expressed his belief that the relation between the garage owners and private owners of automobiles, on the one hand, and the central station on the other, ought to be of the most cordial description. He thought that the greater future growth of the electric automobile business will be in connection with the commercial truck. Information compiled as to the cost of operating this type of wagon indicates that the cost of maintenance is cheaper than that of horse-drawn vehicles.

Speaking of the cost of converting alternating to direct current for charging, the opinion was expressed that the efficiency of mercury-arc rectifiers is considerably higher than that of the motor-generator set under ordinary working conditions. This fact is of importance where only alternating current is available. In Chicago direct current is available as far north as North Avenue, west to Ashland Avenue and south to Thirty-ninth Street. In this district the current can be used direct for charging by the use of a resistance box.

The Commonwealth Edison Company has established a maximum rate of 5 cents per kw-hour for electricity used for charging in public garages. The consumer can secure a lower rate than this on the Wright demand system, where his conditions are such that he can use electricity for charging during long hours. Usually where there is complaint of a high rate, it is found that the cause is due to the fact that the consumer is a short-hour user. If it is possible for public garages to operate so that they can charge long hours at a low demand, the rate for electric energy for this class of service goes to a low figure. For instance, with a maximum of 15 kw 10 hours a day the rate is as low as 3¼ cents per kw-hour, with a corresponding reduction for larger installations and longer hours' use. Should the garage be able to charge batteries for 15 hours a day, the rate on a 15-kw demand would be slightly under 3 cents per kw-hour.

As the average charging time for vehicles is about four hours a day at approximately 3 kw per vehicle, it seems reasonable to suppose that by charging 25 or 30 per cent of the total number of vehicles stored, a garage should be able to use the maximum about 12 hours a day, thus earning a rate that makes the business profitable to the garage owner. Assuming a full charge of four hours every day for the ordinary pleasure vehicle, at the rate above mentioned, the cost of each charge would be about 35 cents.

Curves were given showing the manner in which the rate per kw-hour reduces with the different hours' use of 10-, 15-, 20-, 30-, 50- and 100-hp outfits.

Mr. Lloyd gave the garage rate for the charging and keeping of electric pleasure vehicles in Chicago as between $30 and $40 a month. This includes storing, cleaning and charging of the machine. This method of payment did not appear to the speaker to be the correct one, because not equitable. He thought the equitable way would be to require a fixed payment for the storing and cleaning of the machine and a secondary payment based on the miles run per month. It would be easier to determine the cost of charging the batteries of the average machine, and by putting the secondary payment on a mileage basis the customer will more readily understand how this payment is determined than by fixing payment at a rate per kw-hour. Or there could be a fixed price, made by the garage, for each complete charge. The objection to this method, however, is that it is not always necessary to deliver a full charge to a machine, and for this reason this method would not always be absolutely fair, although on account of the difference in mileage of different machines on the same charge, it may sometimes be preferred. It does not seem to be proper that a doctor having an electric runabout used many miles a day should have the service at the same monthly price as another man who uses his machine only occasionally.

If it is decided to base payment for charging on so much a mile, even this should not be a flat secondary rate, but ought to be varied according to the mileage per month. For instance, up to and including 100 miles a month there should be a certain rate per mile; from 100 to 300 miles a month, the rate per mile should be slightly lower, and for 300 to 500 miles a month a still lower rate per mile should be made, and so on. The reason for this is that the cost of charging for low-mileage users is higher per kw-hour than for a frequent user, even if the garage owner has his own plant. Short-mileage users compel the garage to run the charging apparatus short hours daily. In that case the overhead costs on the garage plant are larger per unit than where the battery can be charged for long hours daily.

Mr. Lloyd stated it to be the desire of the Commonwealth Edison Company to encourage cordial relations between the company and the garage owner. It does not desire to sell energy at a price that is prohibitive, because it knows that its interests and those of the garage owner are identical. If he pays too much for the energy, he loses money on charging the vehicles and therefore becomes a dissatisfied customer. The company stands ready at all times to assist garage owners in

using electricity in the most economical manner, and it believes that with a little co-operation it will be possible to increase the hours of charging considerably over what appears to be the practice at the present time.

A few figures collected during the month of February indicate that the average charging time for public garages on the Chicago central-station system during that month was only five hours. The average bill per customer was $31.12 for public garages and $7.40 for private users. However, in summer the time of charging is no doubt considerably longer. On the other hand, during a bad winter the average charging time during the month of February will be considerably below five hours under present conditions. It would appear that in summer, when the garage owner is put to the most expense for electricity, conditions are such that he could charge batteries much longer hours by slightly rearranging his business. If, under present conditions it is necessary for the garage to make a flat rate per month for charging electric vehicles, an arrangement should be made with customers allowing for a reasonable time for charging.

The maximum rate of 5 cents per kw-hour is fixed to encourage the use of the electric vehicle, particularly its charging in public garages, and this rate is not allowed to private users. The company appreciates that the time of the maximum use of energy is in summer, when it has the most electricity for sale. On this account it offers this maximum rate, which does not appear to be too high for the garage owner to make a reasonable profit.

INTERIOR WIRING AND ILLUMINATION

Illumination in the Past, Present and Future.

It would be most interesting to know the real increase in candle-power hours per capita as exhibited in, let us say, the past 50 years. We start at that early date merely to get back of the petroleum period, at least so far as its full development is concerned. In the days of candles and whale oil and camphene how much light was available? One might delve in musty files of old papers and perhaps find the annual consumption of whale oil, but who to-day could give anything much better than a guess regarding the light produced? To judge from dimensions and appearances, some of the old argand oil lamps might have given ten or a dozen candle-power per burner and the double lamp found on the parlor tables of the well-to-do was therefore good for possibly 20 cp to 25 cp. The smaller and commoner lamps gave hardly more than a quarter of this meager amount. In the larger cities, of course, gas was already common, and on open gas flame was about the same then as now—although a venerable friend, a New York gentleman of the old school, once vehemently asserted that they never had furnished decent gas in the metropolis since they left off making it from resin! The camphene lamp of evil repute on the score of safety gave a whiter and clearer light than the whale oil, but was commonly used in rather small lamps, while coal oil, then recently introduced on a modest scale, gave hope of better things.

To-day there are somewhere about 40,000,000 incandescent lamps connected in this country. These foot up, on the modest assumption of an hour a day of burning, to about 1500 cp-hours per capita. The practical amount is, of course, much more than this since there are millions in the country even now who depend entirely on other lights than electric. Gas lighting would add largely to the total figure and oil would swell the total more than at first thought would seem possible. Altogether, the average person, if such a thing can be imagined, gets an astonishing amount of artificial light in these days, and is steadily demanding more. In the half century past, for a guess, the amount of artificial light exclusive of street lights has increased twenty-fold—perhaps even more. The increase is both in the amount of light and in the hours of burning. People worked longer hours then than now, and in particular the use of light in the morning was greater 50 years ago than to-day. But night is at the present time almost unknown in a modern city, where life hums from dusk to daybreak. We do not remember that any one has ever measured the diffuse illumination of a moonless city night as compared with the velvety blackness of the country. Certainly the difference is conspicuous, almost as great as the difference in noise and the modification of winter temperature. Silence and darkness are alike unknown in a twentieth century city. But at the present rate of increase in lighting one falls to wondering what the next half century will do. Will the gentleman of 1959 sleep at all, and will he use 100-cp lamps where he is now satisfied with modest sixteens? Will the peak be at 5 p. m. or at midnight? Of only one thing are we sure—that the consumer will put up the same old protest and cherish the same old grouch over his monthly bills.

Viaduct Lighting at Kansas City.

By Edwin R. Weeks.

Kansas City, Mo., and Kansas City, Kan., are built chiefly upon bluffs which rise to heights of from 150 ft. to 200 ft., and overlook the bottom land at the confluence of the Missouri and the Kansas (Kaw) rivers. The Kansas River Valley here attains a width of two miles, and is occupied by the wholesale, manufacturing, live stock and railroad interests.

In 1844 this bottom land was overflowed from bluff to bluff. However, the flood of 1844 was so completely out of the memory of men that the great flood of 1903 came as a surprise, and, finding the vast interests of the valley wholly unprepared, severed all the usual means of communication between the cities. An urgent demand arose for an elevated highway to span the lowlands. The two municipalities not being in condition to meet the need, a syndicate of New York and New England capitalists took up the enterprise, and, according to the plans of the civil engineers, Waddell & Hedrick, proceeded to construct a steel and reinforced concrete viaduct from bluff to bluff, thus reducing the team travel distance between the two business centers 25 per cent and the time by way of street car more than 50 per cent.

The present structure comprises about two miles of roadway, two electric elevators to lift teams and loads from the lowland streets to the viaduct roadways, and 8345 ft. of double-track railway. This structure has now been in service for two years, during which time its lighting has caused an amount of popular comment altogether out of proportion to its cost. The lighting features, unique at the opening of the structure, are still noteworthy, transforming the viaduct into "an illuminated boulevard from State to State." As the spectators on the bluffs watch the two parallel rows of lamps stretch in a series of curved and straight lines through the broad valley of the Kaw, they see one of the most striking night spectacles of the continent; so striking, indeed, that impromptu estimates of the total number of lamps in circuit range from 4000 to 8000, while the actual number is only 600. This display never fails to arrest the attention of travelers by rail or boat. It is the most conspicuous feature of the evening view from all prominent points for many miles up the Missouri to the north, the Kansas to the west, and down the Missouri, which here makes a short bend and flows almost due east across the State.

This viaduct was the first roadway to be lighted by the tantalum lamp, which was selected for this purpose by the engineers soon after its introduction. Lamps of 22 cp are placed 36 ft. apart on each side and are staggered to give a symmetrical arrangement and a more nearly uniform light distribution. The circuits are so designed that any one-third of the lamps may be used without changing the factors of symmetry and distribution. Either the north or the south one-half of the lamps, or any one-third of such one-half may also be used separately, thus affording many degrees of illumination to fit the requirements of the occasion. Each lamp is supported by a fluted cast-iron

post and is enclosed in a 10-in. clear glass ball standing 9 ft. 2 in. over all from the roadway. The cast-iron holders are fitted with molded-mica sockets, and molded-mica insulating joints are inserted between the holder and the top of each post. After the lamp has been placed in position it is thoroughly taped to guard against moisture in the socket in case of accident to the glass ball. Flexible rubber rings were first used for this purpose, but it was found that the vibration set up by passing cars caused the rings to unscrew and withdraw the lamps from the sockets, and, in some cases, to project them with sufficient force to break both the lamp and the glass ball. Some trouble was also experienced in keeping down breakage of glass balls, and consequently of lamps, from the wind which has full sweep between the bluffs from three directions. By means of spring-brass clips, however, this difficulty has been overcome to such an extent that during a recent two-days blow (80 miles per hour at times) the loss from this source was less than 3 per cent.

The energy is distributed by direct current on the 250-500-volt, three-wire system, two lamps in series, and the supply is taken by meter either from the three-phase, 25-cycle or the 500-volt, direct-current circuits of the Kansas City Railway & Light Company. In the Viaduct company's storeroom on West Eighth Street are the motor-generator and balancer sets, and double-throw switch and switchboard, with the usual equipment of instruments and apparatus required to utilize energy from either of the two sources above indicated. Since these circuits are fed from dynamos on prime movers in separate power houses, they afford an unfailing supply. This storeroom, as well as all terminal lamp posts and ticket offices, is equipped with at least one lamp on each of the three circuits, to provide light at these points, whichever one of the circuits may be in use. Each ticket office is also wired with a series of carbon lamps connected to the trolley circuit for use in case of accident to both of the regular supply sources.

The purpose of the system of lighting selected was not simply to light the roadways, but was to design a layout which could be made a part of an independent power plant with which ultimately to run not only the lamps on the viaduct and its approaches, together with the roadway elevators, but also several thousand lamps and 12 elevators in a mammoth warehouse to be built in connection with the viaduct. It might also be noted that the civil engineers in charge of this enterprise fell into the common error of architects and other builders in not calling in the electrical engineer until all of the iron for the structure up to the top hand-rail was on the ground and partly in position, thus making it impossible, as was first de-

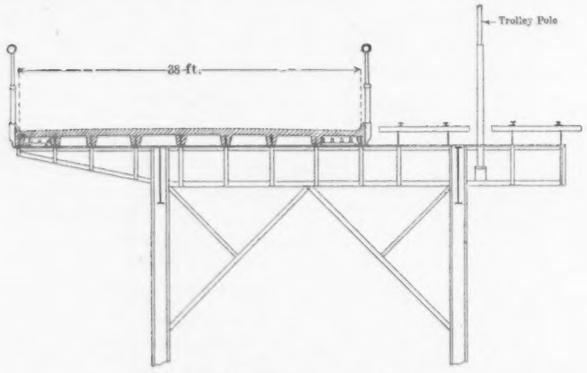


FIG. 1.—SECTION OF MAIN VIADUCT.

signed, to use the hand-rails as conduits for the feeders on the main viaduct. These feeders were therefore placed in the first space underneath the hand-rail; however, when the stockyards extension and other approaches are built, the castings for the base of the posts will be so changed that the original plan can be followed. The three lower rails will then be used as shown in the drawings, the ends being bushed as in conduit work and keyed stationary in each lamp post, with expansion provided for by suitable sleeved gaps in one of the three intervening posts, every fourth hand-rail post being extended into a lamp post.

The desideratum in viaduct lighting is the uniform distribution of a light that will not dazzle the eye. While some arc lamps give more light per unit of electric power than can be produced by the most efficient incandescent lamp, the use of such arcs at necessarily longer intervals—288 ft. according to the service company's plan in this case—produces widely varying degrees of light; gives a painfully brilliant light at some points, injurious to the eyes of both man and beast; instead of

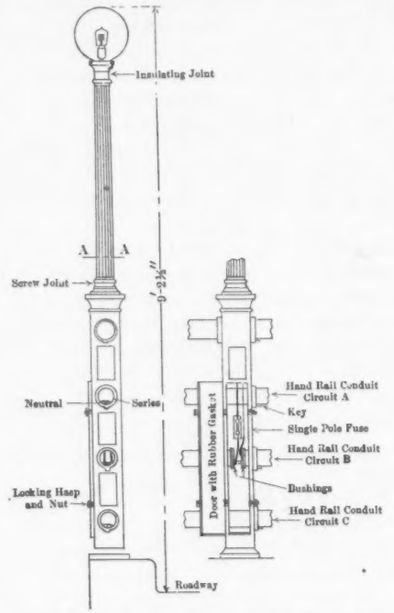


FIG. 2.—DETAIL OF LAMP-POST AND HAND-RAIL CIRCUITS.

aiding sight, it seriously interferes with the ability to see. However, with 22-cp lamps at short intervals the illumination is more nearly uniform, the eye is not dazzled and the sight is not impaired. The lower voltage, better control of degree of illumination, the more striking spectacular effect, bringing out the architectural and linear features, were also among the considerations which led to the selection of the incandescent lamp.

The recent invention of the tantalum lamp offered the only means of further material energy economies, the tungsten lamp not being a commercial article at that time. Some tantalum lamps were, therefore, imported, and after testing them for both candle-power per watt and for effective roadway lighting, as well as for life with direct current and alternating current, and the ability to withstand vibration, an order for 1000 was placed. The vibration caused by passing trains is so considerable that neither Welsbachs nor tungstens could be successfully employed. At any time, however, that the tungsten 125-volt filament is built to withstand this vibration, it can be substituted for the tantalum lamp now in use.

The average lamp life during the first two years' service was 658 hours, which, of course, takes into consideration the breakage by wind and by the not infrequent small boy with stone or air gun, as well as that due to the enthusiasm of adults headed for prohibitory Kansas under loads of Missouri whiskey.

The illumination with all lamps in use is such that a 10-cent piece can be easily seen on any part of the roadway. In a plant 4 ft. above the roadway the minimum is 0.16 ft.-candle and the average is 0.17 ft-candle. The power consumption is 14 kw per mile. The loss due to use of clear glass balls instead of balls with some form of intensive reflector is deemed to be more than offset by the advantage of spectacular advertising.

The system of arc lamps, 288 ft. apart, proposed for this viaduct by the chief engineer of the Kansas City Railway & Light Company would have cost less to install, but the minimum operating expense, even at the city rate of $65 per lamp

per annum (the rate quoted the Viaduct Company was $80), would have been about double last year's expense with the present system. The cost of installing natural gas with Welsbach lamps might have been less, but, at the municipal rate for such service, $12 per lamp per annum, its operation would have been more than twice last year's expense with the tantalums.

TWO YEARS' MAINTENANCE EXPENSE OF 600 44-WATT TANTALUM HIGHWAY LAMPS.

Energy, aggregate, 24 months' meter bills	$1,689.92
Attendant, part of time otherwise employed	1,400.00
Renewals, tantalum lamps and glass balls	979.23
Incidentals, fuel, telephone, oil, etc	149.20
Extraordinary repairs due to flood of 1908 and damage to circuits by iron contractor in repairing hand-rail	404.64
Interest, two years at 5 per cent per annum on $25,000, the added cost of present equipment	2,500.00
Total expense for two years' operation	$7,122.99

As seen from the accompanying table, the total cost of operating the present system for two years on the moonlight schedule, modified, indeed, to meet the state of the weather and the exigencies of business, was $7,122.99, or $5.93 per lamp per annum for each of the 600 lamps in use.

It will be seen from the statement given above that the value $5.93 includes interest on the added cost of the present installation, as well as some extraordinary expenses which should not again occur. The present price of tantalum lamps is also 25 per cent less than was that paid for renewals during the period under consideration.

New Telephone Patents.

DESK STAND.

Messrs. E. R. Corwin and C. A. Bals, of Chicago, have jointly patented a desk stand, their patent having been assigned to the Corwin Telephone Manufacturing Company. The stand has the appearance of the familiar telephone, the patent referring exclusively to the details of construction. The most novel feature lies in the mounting of the entire switching device upon a base-plate, which base-plate may, through the aid of spring clips, be released from its position in the base of the instrument and removed in its entirety. The base-plate carries the switch springs only, the cord to the transmitter proper being attached within the stem of the instrument to a terminal, which registers with a corresponding contact of the base-plate when this is slipped into place. The improvement lies in the easy method of removing the switch springs from the base of the stand so that they may be examined from all sides.

AUTOMATIC LISTENING SYSTEM.

For some time past improvements in manual switchboards have contemplated the automatic connection of the operator's telephone to a cord-pair as soon as this pair is put in use by the insertion of the answering plug in the answering jack of the calling line. Along this same line is the invention of Mr. W. A. Wynne, of Raleigh, N. C. Mr. Wynne, however, associates his automatic listening-relay with the individual subscriber's line, rather than with the cord-pair. To this end he adds a relay to the subscriber's line-circuit, which relay operates in conjunction and simultaneously with the line-signal device to connect the operator's telephone circuits of the corresponding position directly to the calling subscriber's line. When the answering plug is inserted the connection of the operator with the subscriber's line is severed and thereafter she uses a listening key. It is presumably the idea that only one call will come in at a time and that, therefore, the operator will be able to respond to the subscriber and receive his requests without doubt as to who the calling subscriber is.

DEVICE FOR AUGMENTING RECEIVING.

Mr. O. Frazier, of Brazil, Ind., under the title "Telephone," has obtained a patent for an arrangement of circuit which he claims greatly augments the volume of the received sound. His device consists of a coil, in series with a battery, bridged across the transmitter and receiver of an ordinary magneto telephone set. The inventor accurately describes this coil, stating that it is provided with a core and wound with two sizes of wire, a coarse wire next to the core and a fine wire coil of higher resistance wound outside of this, exactly as in the usual induction coil. His patent specifies that two-sized wires such as this must be used and that one end of the coarse wire and one end of the fine wire shall be soldered together, the coils thus being used in series. It is difficult to understand just what is gained by this construction over that used in the ordinary retardation coil.

SERVICE-MEASURING SYSTEM.

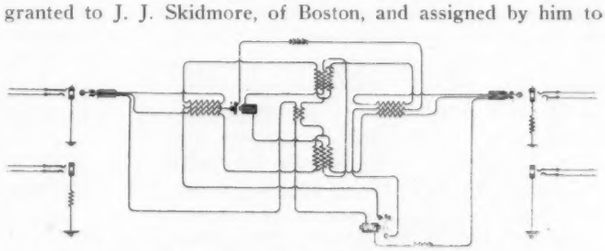
A rather novel idea in measured service is described in a patent granted to Mr. C. M. Beattie, of Rochester, N. Y. There are two elements to this service-measuring system, one of which is a device which counts the number of calls and the other of which is an indicator which records the duration of each call. The latter record is made by means of definitely timed impulses received over the subscriber's line from the central office. These impulses are not sharp changes of current, but are slow variations of the current from the maximum to minimum, definitely timed, the rate of change being so slow as not to be noticeable in the telephone. Mr. Beattie has assigned his patent to the Telechronometer Company.

COMBINED ALARM AND TELEPHONE SYSTEM.

There have been devised recently numerous schemes for combining watchmen's clock systems, fire-alarm systems and burglar-alarm systems with the ordinary telephone line, the idea being to increase the efficiency of the telephone line. Mr. G. Babcock, of Rochester, New York, has patented a system referring particularly to the combination of the telephone system and the watchman's clock. He provides each watchman with a particular style of key, the spindle of which is made like an ordinary telephone plug, while in the handle is a complete step-by-step signal-sending device, such as is used in messenger systems. Each key has its own code of signals to indicate at the central office just which key has been used. The device is so arranged that when a watchman inserts his key and gives it a partial turn to send in a signal, he will automatically wind up a spring within the key handle. When the key is released the handle returns to normal under the action of the spring and by this means drives a make-and-break wheel which transmits the number of the watchman who has called.

NEW REPEATER CIRCUIT.

As is well known, the requirements of operation of the telephone repeater are fast becoming understood, and there have in the last year or two been numerous patents covering devices to meet these requirements and to render this apparatus more and more commercial. Little has been done in the past to make the various adjustments take place automatically. Such an automatic arrangement is, however, described in a patent granted to J. J. Skidmore, of Boston, and assigned by him to



SKIDMORE TELEPHONE REPEATER.

the American Telegraph & Telephone Company. The device is based upon the fact that in order to avoid singing of the repeater the two sections of the line upon either side of it must be in more and more nearly perfect balance the greater the increment given to the talking currents in passing the repeater. This repeater is put in a special cord circuit adapted to be connected to any line, as shown in the accompanying view. The lines of different lengths and characteristics are connected to jacks with different amounts of resistance between the

jack sleeves and earth. This resistance may have any value whatsoever. It will be seen that there is a circuit between the two-plug sleeves of the cord-pair which includes a battery, a relay coil and an induction-coil winding. It will be seen also that the other winding of the induction coil is included in the bridge wire of the repeater circuit. The primary or retransmitting circuit of the repeater is controlled by the relay contacts. If the lines used in any case are short ones and therefore not requiring a repeater, the jack-sleeve resistances will be high enough to cause the control relay to fail. If two longer lines, sufficiently balanced, are connected, the relay will operate and the impedance of the bridge coil will be low because of the low resistance of its secondary circuit. If shorter lines are used where the terminal changes may produce "singing" with a very efficient repeater, the efficiency is automatically reduced through the added resistance of the secondary of the bridge-coil.

Letters to the Editors.

The Patent Situation.

To the Editors of Electrical World:

Sirs:—I have read with much interest the article by Mr. James T. Barkelew in your issue of March 18, entitled "A Phase of the Patent Situation."

It seems to be that strict justice, both to the public and the inventor, is sought for by Mr. Barkelew in his proposed reformation of patent laws. I must, however, take issue with him as to the equity of his views with respect to the "rank-and-file" of inventors, however desirable statutory enactment of these views may be to the "practical inventor"—that is, the successful inventor—the "commissioned officers," to revert to my simile.

Why not take the merchant in a small business and levy burdensome taxes, which, while ruining him, would have but little hardship for his wealthier competitor? True, as Mr. Barkelew gravely observes, his proposed methods, though he formulates no specific measures, would remove "much dead material from the field," but apparently we are not to consider the rights of the owners of this "dead material" secured to them by Federal grants by consent of the whole people. Whatever may be the truth from an ethical standpoint regarding the debt due to society by the individual for his mental as well as his physical environment, the fact remains that the advantage to be derived by a person from an invention, born of his mental processes, is, and of right should be, his. Any other view must be, and is, contrary to the views of a democracy. The law recognizes this and secures the inventor in the enjoyment of what is justly his property. But even so, the law is singularly unjust to inventors and authors under the present patent and copyright laws. The inventor receives no tangible asset from the people—i.e., the Government—by a grant of letters-patent. He only receives a deed which certifies he is the owner of his own property, even as a land-owner proves his right to own land by his deeds securing him the right of ownership. It is unjust that the one deed is limited to 17 years, while the deed of the other, the property owner, secures the right to the enjoyment to himself, his heirs or assigns to the specified property in perpetuity.

The man who by his efforts becomes possessed of an acre of land and the man who by his efforts becomes possessed of a new process or new machine are both property owners. Why should the law differentiate between their respective properties? Is a land-owner required to work his land? I live in a State where hundreds of thousands of acres of land under private ownership are lying fallow. Which will produce the more good to the public, compulsory working of land or patents? True, the inventor pays no taxes on his "property," but this is small compensation for its loss after 17 years.

Mr. Barkelew would even deny the inventor this crumb. He would tax him. And this is not enough: he must work his invention, and do so regularly, or have his property confiscated, to use a polite term. Mr. Barkelew seems to realize to some extent this unjust condition; but on the plea apparently of the greater good to the greater number he feels justified in urging this further abridgment of the rights of inventors, such as taxation, etc.

"The greater good," etc., is democracy, of course, but until it is applied to other property owners it were unjust to single out the inventor—in very truth a most useful member of society—whose hands and mind more than others are not shackled or trammeled by the gross conservatism that sneered at Stephenson and laughed at Watt, that has persecuted with undeserved odium every man with a new idea. The discerning man cannot shut his eyes to the fact that the "age of steel" is as much the product of the inventor as of the business man. I appreciate Mr. Barkelew's frankness; I believe in his sincerity, but I protest against his conclusions. As one of the "ridiculed," the "average inventor," the genius if I succeed, the fool, the crank, if I fail—for such is the portion of the "average" inventor—for the good of inventors at large I respectfully ask for them a hearing in your columns.

Barstow, Tex. William C. Mayo.

[Another communication commenting on Mr. Barkelew's article, by Mr. Gorham Crosby, will be found on page 866. Both Mr. Mayo and Mr. Crosby, however, indulge in generalities which have little or no specific bearing on the patent situation of the moment. A patent system ideal in form and spirit would, if perverted, be of little avail either to the inventor or to the public. The matter at issue appears not to be the actual imperfection of our present patent system, but the manner in which it is administered to the detriment of the bona-fide inventor.—Eds.]

The Tariff Bill and Patents.

To the Editors of Electrical World:

Sirs:—Section 41 of the Payne tariff bill provides that whenever a patent is issued by the United States to a foreign patentee it shall be subject, with respect to the manufacture of the invention covered by said patent in this country, to all the conditions that are imposed by the native country of the patentee to citizens of this country, who have obtained a patent in said country.

If such a measure should pass and become a part of the patent law of this country it would no doubt be greeted with a sentiment of great satisfaction on the part of all those who obtain patents in foreign countries where patentees are called upon to put their inventions upon the market within a certain period, subject to revocation of the patent.

Personally, I am inclined to the opinion that such a measure as proposed by section 41 referred to must be considered only fair and, in my opinion, it will do more to bring about a much-desired and much-discussed amendment in foreign patent laws as regards the requirement of actually working a patented invention in the country where the patent issued, than any negotiations carried on through diplomatic channels.

It is perhaps known to the readers of your publication that Switzerland has already waived, regarding patents issued to citizens of this country, the requirement that a patented invention must be carried out in Switzerland; and negotiations are also pending now between this country and Germany to cause Germany to also waive the request that an invention patented in Germany must be actually carried out in Germany, where the patent was issued to a United States citizen.

At the last congress of the International Association for the Protection of Industrial Property, held at Stockholm, the question of compelling the patentee actually to work an invention in the country where the patent issued was again the subject of an extended discussion, and the representatives of the various countries unanimously, I believe, advocated the insertion in the patent laws of the different countries a clause that a patentee should be compelled to grant a license or licenses, upon

reasonable terms, to manufacturers who desire to place the invention on the market where it could be shown that the invention was not carried out at all or that the public demand for the patented article is not sufficiently complied with. Such a clause is, in my opinion, not only entirely justifiable, but will also prove of great benefit to the industry of every patent-granting country; and if a bill containing such a clause were introduced in this country, it should, and certainly would, I believe, meet with the hearty approval of the manufacturing industry of this great country.

New York. Alfred Müller.

Even Harmonics in Alternating-Current Circuits.

To the Editors of Electrical World:

Sirs:—In the issue of March 25, page 734, is an interesting communication by Dr. Steinmetz on even harmonics in alternating-current circuits. The facts cannot be disputed, but I wish to call attention to an innovation in the use of the term *harmonic*.

Technically, it is always understood that a quantity to be harmonic must be capable of analysis into a constant plus a series of simple sine or cosine terms whose frequencies are all whole multiples of the fundamental, such as

$$i = A_0 + A_1 \cos (wt - \delta_1) + A_2 \cos (2wt - \delta_2) + \text{etc.} + A_n \cos (nwt - \delta_n) + \text{etc.}$$

This equation must hold for all values of the time t—that is, for subsequent as well as the first complete period. It is evident that in the case cited by Dr. Steinmetz, the equation for the current i does not conform to the facts in subsequent periods of the electromotive force, and that therefore the current is not harmonic in the strict sense of the term. The transient wave under discussion may be analyzed into two parts, one harmonic and one non-harmonic. The former part must have odd multiples only, unless the circuit has parts of rectifying tendencies.

It seems to me, therefore, fair to say that the case under discussion is not a harmonic wave with even harmonics (even multiples) present.

Ann Harbor, Mich. Geo. W. Patterson.

To the Editors of Electrical World:

Sirs:—When a switch is closed connecting a transformer to an alternating-current circuit, the exciting current which flows is not at first periodic[1] for two reasons: The magnetic condition in which the core has been left by previous use is not in general that which would correspond (in the normal cycle) to zero current. Secondly, closing will not, in general, be made at the point in the e.m.f. cycle corresponding to zero current. For the current to have a periodic variation these two conditions must be fulfilled, but ordinarily they are not fulfilled, and a large first surge may result upon closing the circuit. After a number of reversals the current gradually approaches its normal value and becomes periodic. In the meantime it may be said to have a definite frequency, since it has a maximum or minimum value every time the e.m.f. passes through the value zero. It does not necessarily reverse in direction, however, as is illustrated in the oscillogram of Mr. T. Jensen, shown in your issue for Sept. 14, 1907, where in one case the current is unidirectional for the first three half-cycles of e.m.f.

To speak of the harmonics in such a non-periodic quantity seems meaningless, yet in the *Electrical World* for March 25 Dr. Steinmetz takes this case as an illustration of an electric current in which *even* as well as *odd* harmonics accompany the fundamental frequency.

Any variable quantity which returns after a certain time T to its initial value can by the method of Fourier be resolved into periodic components, each having a frequency equal to some integral multiple of $\frac{1}{T}$. If the quantity has the same series of values recurring after each interval T, the Fourier series represents the permanent wave-train. Each term in the Fourier series then has a physical meaning, as it represents an actual harmonic component which repeats its alternations indefinitely. When the values are not repeated during successive periods, the harmonics cannot be said to have any physical existence. The expression still gives a mathematical representation of the function during a limited extent of its range, and only in this range, for if other values of the time are substituted in the expression the corresponding value of the varying quantity does not agree with its actual value.

Nothing makes this point more evident than to carry out the analysis with the use of the measured ordinates of the curve in the first half-cycle only. When only odd harmonics exist in a wave this is all that is necessary to give a complete analysis, since the same numerical values of the ordinates are repeated in the second half-wave. Such an analysis carried out in the case cited by Dr. Steinmetz would give a series of terms containing only odd harmonics, which would represent the first half-wave correctly, but would not give proper (actual) values for the second half-wave. It is for that reason defective in the same way that the series of terms given by Dr. Steinmetz is defective, and does not admit of any physical interpretation. Judging by the above analysis one would say that there were no even harmonics in the first half-wave; judging by Dr. Steinmetz's series, one would say that even harmonics were present; neither is correct, for only a periodically varying quantity may properly be said to contain harmonics.

It seems unfortunate that Dr. Steinmetz should have picked out this case as an example of unsymmetrical waves since such waves, containing even harmonics, are easily produced in other simple cases, such as a bipolar generator with unsymmetrical poles. I have produced them by coupling together the shafts of two generators giving, respectively, 60 and 120 cycles and connecting the terminals of the generators in series.

In conclusion I would point out that the final paragraph of the article referred to is very misleading. Dr. Steinmetz says: "In the permanent as well as in the momentary exciting current of the transformer, all harmonics are approximately in phase; that is, they add their maximum values and hence the wave is peaked."

Now, when the fifth, ninth, etc., harmonics are in phase with the fundamental, a maximum of the harmonic coincides with the maximum of the fundamental, but with the third, seventh, etc., harmonics, a minimum of the harmonic coincides with a maximum of the fundamental. Consequently, with both sets of harmonics occurring in phase, the troughs of some counteract the crests of others, and the wave may be quite flat. I think it is from one of Dr. Steinmetz's valuable books that I have made this note of the equation for a wave which is very flat: $e + \sin\Theta + 0.225 \sin 3\Theta + 0.053 \sin 5\Theta$.

Washington, D. C. M. G. Lloyd.

Starting Induction Motors.

To the Editors of Electrical World:

Sirs:—The method of starting induction motors, described by Mr. E. J. Willis in your issue of March 25, is certainly of great interest to many motor manufacturers and designing engineers. At the first glance the method appears to be very good, and even superior to any other. It should be noted, however, that the addition of a starting winding in the motor has a number of serious disadvantages over the rheostat or the auto-transformer method, and some of which are as follows:

Placing extra turns for starting inside the motor adds to the machine the complications incident to a separate starter. Experience in repairing windings proves that a winding which can be repaired with the least trouble and in the shortest time is the best.

An induction motor with the combination winding suggested

[1] By a periodic quantity I understand one which repeats the same series of values after a definite time, called the period, or one in which this series of values is regularly decreasing, as in a damped wave.

by Mr. Willis has twice as many connections and in total from 20 to 50 per cent more turns than would be required if the motor had no starting winding. From this fact it is apparent that besides the added complication and difficulty of winding, there are also many more chances for short-circuits and other trouble due to increase in number of turns and connections.

As far as the performance in starting is concerned, the arrangement mentioned by Mr. Willis and the auto-transformer arrangement are practically equal if both are properly designed. On the other hand, the losses in starting are of small importance unless the motor is to be started very frequently.

In order to obtain a proper performance under running conditions it is necessary to make the motor with the combination winding larger on account of the necessity for deeper slots and consequently higher leakage constant. Mr. Willis states that the depth of the teeth are to be increased approximately 25 per cent and the stator diameter about 25 per cent. These figures can, however, apply only on some particular motors, as the size as well as the characteristics of the motor will affect the percentage. The percentages given by Mr. Willis appear small, but it does not follow that the increase in cost would also be small, as the actual weight of copper and punchings will be increased considerably, and the labor will also be increased, thereby obviously increasing the cost of the motor. Furthermore, it will be rather difficult, or practically impossible, to make the starting winding inside of the motor adjustable for different starting torque or starting current.

From the few points outlined above it can be seen that the scheme of placing a starting winding in the motor or, in other words, in high-priced storage-rooms, is very undesirable.

Pittsburgh, Pa. H. C. Specht.

Suggested Effect of High-Tension Mains.

To the Editors of Electrical World:

Sirs:—I see in certain American papers a statement that the high-tension mains which convey 14,000 hp from the Muskegon River to Grand Rapids, Mich., are worked at a voltage of 110,000, over a distance of 50 miles; and it is suggested that both agricultural and other effects may be anticipated from the visible brush discharge from these elevated mains.

I suspect that the brush discharge is most marked in the immediate neighborhood of the metallic poles or towers which support the insulators, and is weak in between. Nevertheless, some effect might be anticipated if the potential were continuous, or of one sign; but, inasmuch as it is sure to be alternating, any expectation of an influence on crops or on fog is almost bound to be disappointed. A negative result is to be expected beforehand.

Birmingham, England. Oliver Lodge.

[The brush discharges referred to are only visible on very dark nights, and then only faintly. The discharges occur on all parts of the line, and are not noticeably increased near towers. In the substation, with all lights out and the room in total darkness, brush discharges are also easily discernible, even when not visible along the line. In a recent test, when the line voltage was raised from 110,000 to 120,000 volts, the intensity of the brush discharge was considerably increased.—Eds.]

Expert Testimony.

To the Editors of Electrical World:

Sirs:—I have read with great interest your editorial in the issue of Feb. 11, entitled "Expert Testimony," and desire at the outset to state that it is by all odds the most rational dissertation upon the subject that I remember to have seen. Having had over 25 years' experience as a teacher of the common law and as an expert, I desire to emphasize some points while modifying others.

So far as I am able to judge, there is only one species of statements that may not be open to difference of opinion, namely, mathematical demonstrations. The degree of certainty in ordinary human affairs can never rise above what is called moral certainty, and the contrary is always conceivable. For the great majority of disputed questions of fact the evidence does not rise to the dignity of moral certainty, but ranges from a slight to a high degree of probability, the humane rule of reasonable doubt requiring a higher degree of certainty in criminal than in civil cases in order to warrant a conviction.

Why, then, since we find difference of opinion in science, art, law, medicine, politics and theology—notably in the last three, as witness the various parties, schools and sects—should expert evidence stand alone as requiring a unanimity of opinion formed in no other sphere of human experience? Expert witnesses stand upon precisely the same ground as other witnesses; and their ability and integrity, once their capacity has been established upon a preliminary examination to a sufficient extent to warrant their admission as witnesses, are subject to the same tests as those of other witnesses. There is no more reason for the adoption of a special rule as to experts than in the case of other evidence.

If those who so vehemently declaim against expert testimony would take the pains to investigate the law and practice upon the subject of opinion evidence, they would find that the fault is not with the law; that the rules upon this important subject are reasonable and just, and that in the average lawsuit upon the trial of a contested issue of fact, there is quite as much conflict of testimony on contested facts as upon matters where opinion evidence is admissible. They would also find that under the control of able courts and counsel, results quite as accurate are reached under the common-law form of procedure as in foreign systems of judicature.

The fact is that the difficulty is inherent in the subject matter and cannot be remedied by changing the form of the tribunal. The remedy, then, so far as there is one, lies, as you have justly stated, with the court and counsel. The nature of the subject matter cannot be changed. The notorious abuse of the privileges of counsel in the exercise of cross-examination—that supreme test of truth—can and ought to be corrected by the court, which, while allowing the utmost latitude in the search for truth, should never allow it to be perverted into an engine of oppression and abuse. I do not see, however, under our system, how the right of counsel to call such witnesses as they see fit to support their side of the issue, can be curtailed so long as the witnesses properly qualify. Judicious cross-examination is here again the supreme test of truth, and so long as our tribunals are human I know of no better test.

In my experience as an expert this privilege of counsel is rarely abused. I have had only five or six cases in which I could justly complain of court or counsel, and in these cases, by reason of my long experience, I was able to take good care of myself.

I do not believe that an officially appointed band of experts would remedy the evils complained of, and it would be likely to introduce others equally bad. Craft and graft, political pull and brazen effrontery, coupled with lack of knowledge on the part of the appointing power of the real merits of the men seeking appointment, would, in my opinion, deteriorate rather than improve the present conditions.

Again, as you so well state, the position of an official expert, to be paid at a nominal figure and blackguarded in cross-examination by both sides, is not one for self-respecting persons to desire, and most likely the incumbent would merit the abuse. A really honest, modest and capable man would be at a decided disadvantage under such a rule, while the limitation of nominal compensation would be disregarded in practice. The compensation of experts will, like everything else, be subject to the law of demand and supply, and parties and courts will get no more real value than is paid for.

Again, in criminal cases, constitutional provisions will prevent any such plan as a submission to referees. It is a well-settled principle of American constitutional law that in all criminal prosecutions the accused shall enjoy the right to be confronted with the witness against him and to have compulsory process for obtaining witnesses in his favor. See Cooley's Constitutional Limitations, p. 318; Const. U. S. Amendments, art. VI; Const. Ill (1870), art. 9, and other State constitutions.

Any change of this salutary rule would, judging by past experience, probably introduce evils and abuses greater than those sought to be remedied.

What then is the remedy for these and other abuses?—which I do not admit are greater than many others, nor a tithe as great as the sensational press would have us believe. I answer that it cannot be remedied in a day by statutory law. It must be left to an enlightened public opinion, care in the education of candidates for admission to the bar, full and fair cross-examination under the direction of an able and fearless court. Under these conditions miscarriages of justice will be more rare than they now are. Indeed, under present conditions, so far as my experience extends, such miscarriages of justice are very rare. When they do occur they are known far and wide and exploited by the press to the utmost limit, while in hundreds—nay, in thousands—of other cases of which the public hears nothing, there is no just ground for complaint. To limit and obstruct the use of expert testimony because its use is sometimes abused would in many cases operate as a denial of justice. In many cases there are no other sources of information open to court and jury.

CHICAGO, ILL. MARSHALL D. EWELL.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Air-Gap Reluctances.—W. HARTNELL.—A communication on the amp-turns necessary to send a given flux across the air-gap of a dynamo with a slotted armature. The author gives the following formula, which is practically correct for the usual proportions of teeth and slots: Let L = the length (effective) of the pole face, assuming that there were no slots (see Fig. 1); S = width of slot; G = width of air-gap. Then deduct for each slot a length $= \frac{S^2}{4G+S}$. For example, let $L = 195$ mm, $S =$ 12 mm, $G = 3$ mm. The space lost by each slot would be 6 mm according to the above formula. If on the average there were 7½ slots under the pole, the effective length of the slotted armature under the pole face would be $195 - 7\frac{1}{2} \times 6 = 150$ sq. mm. From this the amp-turns to drive the given flux across the air space can be calculated as usual for an armature carrying no current. The above formula is based on the conclusion

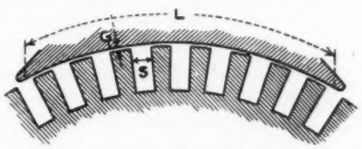


FIG. 1.—AIR-GAP RELUCTANCES.

that the effect of the slot is nearly equivalent to lengthening $G + S \div 4$, the flux over the slot.—Lond. *Electrician,* March 19.

Speed Variation of Induction Motors.—A note on a recent British patent (4113, 1908; March 11, 1909) of W. Fairweather. The stator winding can be connected for either two-phase or three-phase working; by changing over from three-phase to two-phase, the synchronous speed is increased by one-third. To supply the two-phase currents from the three-phase supply, either the Scott arrangement can be used, or, as described in the specification, special auto-transformer windings can be provided on the stator of the motor. By arranging for different numbers of effective poles in the usual way a series of different speeds can be obtained.—Lond. *Elec. Eng'ing,* March 18.

Tests of Alternators.—P. GIRAULT.—A note in which the author simplifies the method of Potier which requires the knowledge of a wattless characteristic curve. The present author shows that only one single point of this curve is required if the short-circuit curve is known.—*La Lum. Elec.,* March 13.

Three-Phase Induction Motors.—W. ROGOWSKI AND K. SIMONS.—The conclusion of their illustrated paper on stray fluxes in three-phase induction motors. The authors describe new methods for measuring the stray fluxes and for predetermining them.—*Elek. Zeit.,* March 18.

Lamps and Lighting.

Tungsten Lamp.—An account of a recent British patent (25,577, 1908; March 11, 1909) of the British Thomson-Houston Company (the General Electric Company of this country). Powdered tungsten is mixed with cupric oxide and a cadmium-bismuth amalgam, and the resultant mass is squirted into filaments. On baking, the mercury is distilled and some of the cadmium reacts upon the cupric oxide, thereby producing copper and cadmium oxide. On further heating in a vacuum, the remaining cadmium, the bismuth and finally the copper and the cadmium oxide are evaporated. This last component soaks up the liquified cadmium and bismuth at the earlier stage and prevents the formation of globules of molten metal, which affect the uniformity of the filament. The remaining tungsten is finally sintered together.—Lond. *Elec. Eng'ing,* March 18.

Metallic-Filament Support.—An account of a recent British patent (3248, 1908; March 11, 1909) of H. Hoge and the "Z" Electric Lamp Manufacturing Company. A circular base of glass or porcelain, with small holes all around its periphery, is fixed in the neck of the lamp and the resilient supporting wires, insulated from each other, rise from the center of this base. A leading-in wire enters the same hole in the base as the beginning of one filament loop and is welded or cemented to it. The end of the first loop enters the same hole as, and is cemented to, the beginning of the second loop, and so on. Each loop is supported at the top by being passed through a ring at the extremity of a supporting wire. Two separate circular bases, one for the supports and the other for the filaments, may be fixed in the neck of the lamp, each being pierced at the periphery as described.—Lond. *Elec. Eng'ing,* March 18.

Exterior Lighting.—E. L. ELLIOTT.—An illustrated article giving general considerations on exterior lighting. Reference is made to an empirical rule that a street may be considered suitably illuminated when it is possible to read the time on the face of an ordinary-size watch having black symbols on a white ground. The average eye can readily do this with an illumination of 0.01 ft.-candle. The author then discusses three methods of measuring illumination, whether on the horizontal, vertical or normal (the latter meaning illumination on a surface perpendicular to the rays of light). The author in discussing the three methods is inclined to give a preference to the one last mentioned.—*Illum. Eng.,* March.

Generation, Transmission and Distribution.

Gas Power.—C. E. LUCKE.—A discussion of the gas-power plant as a means of fuel conservation. While in all cases gas-power plants can be made to generate energy for less fuel than can steam plants of the same size, the saving in fuel is in some cases accompanied by a saving in energy cost, and is, therefore,

	Cost per hp-hour
Fixed charges on investment of engine producer, electrical generator, switchboard, foundation, building, pipings, etc.	0.364 cent
Repairs and maintenance	0.046 cent
Labor	0.474 cent
Miscellaneous	0.046 cent
Coal	0.253 cent
Lubricants	0.106 cent
	1.289 cents

a profitable thing to do, while in other cases it is not. The differences of conditions that produce the different results are chiefly those of size of plant and kind of fuel supply. The gas-power plant is not yet completely adapted, although rapidly

becoming so, to all kinds of fuel, and many of the most popular kinds of coal, notably of the bituminous sort, are still giving the producer trouble. For small power plants, in the neighborhood of 100 hp, gas is most satisfactory. The author gives the figures tabulated on page 877 for a 75-hp gas-producer and engine plant burning small anthracite coal at $4 per ton of 2000 lb. and operating at full-load half the time. These figures are based on an expensive type of plant and with liberal labor allowance and a high price for coal.—*Eng. Mag.*, April.

Cost of Energy.—J. A. Jeckell.—A paper read before the Birmingham and District Electric Club on reducing the cost of energy in works and factories. The author points out the importance of reducing the standing charges and discusses the wasteful way in which, in many cases, energy to drive factories is made and used. He advocates the testing of coal every week or month, to pay attention to soft-water supply and to the removal of oil from water before returning it to the boiler. He also discusses the use of mechanical stokers and the necessity of careful tests of the engines, and the best ways of arrangement of shafting. It may pay to drive one part of the works by electric motors supplied with energy from the town mains, and to drive the rest of the works with a non-condensing steam engine, the exhaust steam being used in winter to heat the shops and in summer to heat the feed water to the boilers.—Lond *Electrician*, March 19.

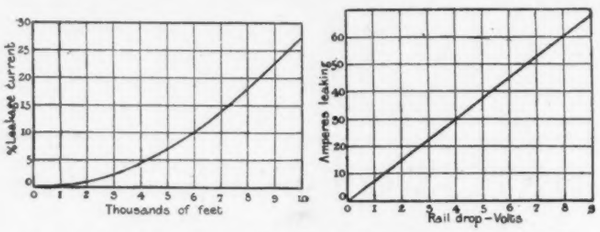
Water-Power in Dalmatia.—H. Tenzer.—The first part of an illustrated description on water-power developments at the Kerka River in Dalmatia. In 1894 a small plant was erected containing a 300-hp turbine driving a 220-kw single-phase alternator. The energy is transmitted to a factory. In 1898 an experimental plant for calcium carbide manufacture was erected, and a larger commercial plant for the same purpose, with a capacity of 5000 hp, was opened in 1903. Recently a still larger plant, containing four sets of 6000 hp each, was erected, three-phase currents being generated at 3000 volts, the frequency being 42. The article is to be concluded.—*Elek. Zeit.*, March 18.

Power-Station Design.—A fully illustrated summary of power-station designs adopted for railway or general public-service plants, ranging in rating from 800 kw to 24,000 kw, and for use where space limitation is not the determining factor. The article is accompanied by statistical tables and plans of different stations. The summary includes reciprocating-engine, turbo-generator, combined turbine and reciprocating-engine, and gas-engine installations.—*Electric Railway Journal*, March 27.

Raw-Hide Gearing.—R. Livingstone.—An article giving tables and diagrams showing the amount of power which raw-hide gearing will transmit.—Lond. *Electrician*, March 19.

Traction.

Stray Current from Electric Railways.—J. G. and R. G. Cunliffe.—A paper read before the Manchester Section of the (British) Inst. Elec. Eng. The reasons for the non-fulfilment of early predictions of electrolytic destruction, due to "vagabond currents," are discussed, also the possibility of much damage being encountered and the precautions thereby rendered necessary. The general mass of the earth is at a uniform potential and behaves like a conductor. The potential of normal earth can be changed locally owing to the high specific resistance of the soil. For practical purposes the authors have fixed the limiting distance at 3 ft., to which the influence of a track, having a drop of potential below 7 volts, extends. (A drop of 7 volts as maximum "between the points of the uninsulated return furthest from and nearest to the generating station" is fixed by the British Board of Trade regulations.) There is a much heavier current flowing in the trolley wires than in the rails, and it is this difference which is responsible for magnetic disturbances experienced at a distance from the track. If the vagabond current flowed in the ground close to the rails such disturbance would be at a minimum, and the further away the currents flow the greater is the magnetizing effect. The length of the section must, therefore, be limited in cases where it is of unusual importance that the magnetic disturbance should be as small as possible. Fig. 3 gives the relationship between rail drop and vagabond currents, with given length of section, and Fig. 2 shows the effect of length of section on the leakage currents. Claude found from 12 to 15 per cent of the total current to be vagabond on complicated networks, and 25 to 30 per cent on long lines, while Parshall found that on a line eight miles long the vagabond current was as high as 60 per cent of the total. Neither Claude nor Parshall could find any appreciable



FIGS. 2 AND 3.—STRAY CURRENTS FROM ELECTRIC RAILWAYS.

current flowing in the pipes, and a most careful search of the Manchester system affords no evidence of such currents. The potential gradients indicate that after overcoming the resistance due to bunching, encountered within 3 ft. of the rails, the current has become diffused over such a wide area that practically no further resistance is opposed to its flow—that is, a pipe situated over 3 ft. from the rails would carry little more current than if made of earth, and the majority of pipes are at a greater distance than this. Whatever current does, from any cause, enter the pipe must do so with a very low-current density and at a distance from the point at which it leaves the rails and must leave with a low density at a distance from the negative feed point owing to the lower resistance of a long return path than of a short one. Summing up, then, it appears that: (1) In order to reduce danger of corrosion to a minimum it is necessary that the rail drop should be limited; (2) the limits generally imposed are still too high to afford protection against magnetic disturbances, and, therefore, special regulations fixing the maximum length of section ought to be imposed in important cases.—Lond. *Electrician*, March 19.

Electric Energy Transmission for Main Marine Propulsion.—An illustrated description of the "paragon" system of W. P. Durtnall. In Fig. 4 the turbine (or gas engine) shaft *A* is shown driving a three-phase alternator, *B* being the rotating field magnet and *C* the stator. An exciter *E* supplies continuous

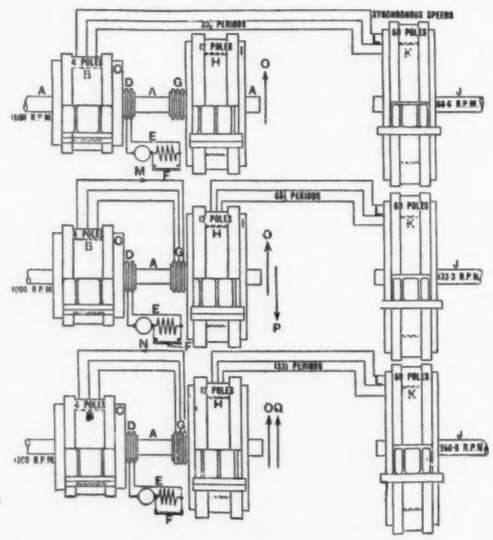


FIG. 4.—MARINE PROPULSION BY ELECTRIC ENERGY.

current to the rotor *B* by means of the slip-rings *D*, and a switch *F* is provided for short-circuiting the exciter for making the system "dead." In the first diagram the current is taken to the motor coupled to the propeller shaft *J*. This motor is of the squirrel-cage type, *K* being the short-circuited rotor and *L* the stator. This arrangement gives a low speed for the

propeller shaft. For intermediate and high speed, while the exciter field is short-circuited the connections are changed, as shown in the second and third diagrams. In these the current is seen to be taken through a rotary transformer, the primary of which is indicated by *H* and secondary by *I*, the primary being connected to the turbine shaft *A*. By altering the connections so that the magnetic flux in *I* revolves with or against the rotor, current of two frequencies can be supplied to the stator of the squirrel-cage motor, thus giving the intermediate and high speeds of the propeller shaft. In this way three speeds are obtainable from the squirrel-cage motor coupled to the propeller shaft. By merely altering the connections from the three-phase generator *BC*, the direction of rotation of the motor can, of course, be easily reversed, while for starting up or revolving the propeller at very low speeds, the stator *C* of the generator is allowed to revolve in bearings. If allowed to revolve freely, it will, of course, attain practically the same speed as the rotor, but if braked it will then supply current of very low frequency to the squirrel-cage motor, which latter will run at correspondingly low speeds. In this way any speed desired can be obtained at the propeller shaft and it is important to notice that at whatever speed the latter rotates the turbines are always running at their maximum, and, therefore, most economical speed. The advantages of the system are pointed out.—Lond. *Electrician*, March 19.

Mountain Railway.—R. Gundell.—An abstract of a paper on the electric equipment of the mountain railway in Wildbad, Germany. This is a cable road, the cable being driven by a 60-hp motor. Energy is supplied from the lighting network of the city, but in order to equalize sudden changes of load a storage battery is provided.—*Elek. Zeit.*, March 18.

Interurban Railway.—An illustrated description of the Oregon electric railway system which consists of a high-speed interurban electric railway, 50 miles long, connecting the cities of Portland and Salem, Ore., with a branch line 20 miles long to Hillsboro.—*Electric Railway Journal*, March 20.

Installations, Systems and Appliances.

Protection of Low-Pressure Circuits.—G. Kapp.—A description of a safety device for low-tension circuits. The apparatus can be adjusted to switch out automatically such circuits as soon as the potential of any part of the same with respect to earth exceeds a certain predetermined value. In cases where transformers are used it is often required by the regulations that a breakdown between the high-pressure and the low-pressure sides must either be prevented or made non-injurious. In spite of the opinion of other engineers, Goerges has proved experimentally that this condition can be fulfilled by an excess-pressure safety device consisting of a thin sheet of mica placed between two electrodes. These electrodes become welded together even with quite small currents, so that within a few seconds the low-pressure line is either earthed or short-circuited, as the case may be. It has been found that the device is made still more effective by inserting tinfoil between the electrodes and the mica. As a result of a prize competition in Italy a new protective device, which has proved very satisfactory, has been designed by Arcioni. Arcioni's solution is based on the principle that the safety device must not be limited to the transformer alone, but it must protect the whole network where breakdowns are also possible. The determining factor on which the action of the protecting device must be based is solely the potential of the conductor with respect to earth. The apparatus exhibited was intended for three-phase circuits, and consisted of three parallel alternating-current magnets, symmetrically placed around an axis. One-half of each pole was wound with short-circuited coils, so that the damping effect thus caused a torque to be exerted on an aluminum disk in front of the poles. To prevent the rotary field of the three magnets acting, the inner portions of the disk were cut away, thus leaving three broad arms displaced at 120 deg. Consequently only the three alternating fields act between the poles and the arms of the disk. The latter is not allowed to revolve, but only to move through a small angle sufficient to close a relay, when the sum of the three torques becomes large enough to raise a counterweight. The exciting coils of the magnets are connected to the three conductors and joined in star, the start point being earthed. Hence, so long as the insulation of all three conductors is the same and there is no breakdown from the high-pressure side to low pressure, each magnet is excited with 87 per cent of the interlinked pressure. The counterweight is adjusted so that it is not raised by the torque existing under these conditions. Further, on account of their very high frequency, the torque exerted by each pole is proportional with respect to earth. Consequently any displacement of the neutral point means an increase in torque, so that by suitably adjusting the counterweight the apparatus can be set to actuate the relay as soon as any predetermined limit of pressure is exceeded. The relay can be made to operate the main cut-out of a short-circuiting device of some description. Experiments were made with this apparatus in the substation at Porta Volta, in Milan. The interlinked pressure was 170 volts at 42 cycles, the normal potential of a wire above earth being thus 98 volts. The high-tension side of 3700 volts was now placed in contact with one of the low-tension conductors and it was found that the safety device never failed to operate as soon as the pressure reached 174 volts, the current flowing from the neutral point to earth being about 30 milli-amp. Normally, the potential of the neutral point with regard to earth was zero, and no current flowed. The apparatus, therefore, satisfied the additional condition that it should cause no telephonic disturbances.—Lond. *Electrician*, March 19.

Combined Lighting and Heating System.—C. F. Holmboc.—When considering the question of erecting a special generating plant for a large office building, or buying the energy from a central station, one should consider the possibility of installing a combined lighting and heating system, exhaust steam being used for heating. In the case of buying the energy from the central station it is necessary to install a separate heating system. The author considers the advantages which can be obtained with the combined lighting and heating system for two cases: in the first, the different concerns in the building have to pay for lighting according to the energy consumed, which is determined by meter; in the second case, they pay for lighting a yearly flat rate.—*Elek. u. Masch.* (Vienna), March 14.

Electricity on Board Ship.—A. P. Chalkley.—A paper read before the Newcastle section of the (British) Inst. Elec. Eng. While generally an e.m.f. higher than 120 volts is not used on shipboard, the considerable quantity of cables required makes a higher voltage advisable in many cases. One of the new British battleships is to be equipped with a three-wire system with 220 volts between the outers, the lamps being used at 110 volts and the motors working on 220 volts. Turbo-generators have decided advantages over reciprocating engines on board ship. The author then discusses in some detail the methods of wiring, heating and ventilation, of forced-draft fans, auxiliary uses for electric motors, and electromechanical propulsion.—Lond. *Elec. Engineer*, March 19.

Charging for Electrical Energy.—W. T. Ryan.—A comparative discussion of the following nine principal methods of charging for electric energy: Flat rate; meter rate; classification of rates (domestic lighting, motor service, etc.); Wright maximum-demand system; Doherty rate, "four C system" (equipment charge and energy charge); double-rate meter; a charge based on the customer's minimum monthly guarantee; combinations of the above.—*Eng. Mag.*, April.

Leeds Electricity Works.—The conclusion of the illustrated description of recent extensions to the lighting station of Leeds for energy supply purposes. The switchboard arrangements are described in detail. Extensions have been made since the system was changed over from single-phase to two-phase. The supply to all consumers is now two-phase at 200 volts (in a few exceptional cases a supply being given at 400 volts), and where direct current is required a motor-generator is usually installed.—Lond. *Electrician*, March 19.

Wires, Wiring and Conduits.

Earthing the Middle Wire.—It is the general custom in England to comply with the Board of Trade regulation in regard to

earthing the middle conductor of a three-wire system by inserting a resistance between the middle wire and the earth connection, such resistance being frequently short-circuited by a fuse. That an "earthing" device is not essential to the satisfactory and safe operation of an electricity supply network is proved by the excellent record pertaining to the electric supply department of the St. Pancras Council. Notwithstanding that this Council's mains have been in use for 13 years without an "earth" connection, no fire or accident on a consumer's premises has been attributed to electrical causes, nor has any trouble, beyond that arising from external damage, been experienced with the mains. The non-observance of the regulation has, however, recently been brought to the notice of the board and it has now been decided to connect the middle wire of the system to earth through an automatic switch arranged to break the circuit when the current exceeds 25 amp.—Lond. *Electrician,* March 19.

Electrophysics and Magnetism.

Properties of Matter.—J. J. Thomson.—A review of his first three lectures before the Royal Institution on the properties of matter. The author discusses the principal reasons for assuming non-continuity of the structure of matter; the range of molecular attraction; the vortex theory of ether; the electronic theory of matter and its relation to radioactivity, and the theory of gravitation.—Lond. *Electrician,* March 19.

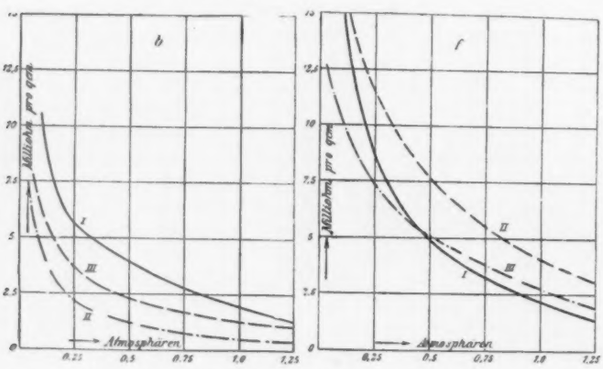
Electrochemistry and Batteries.

Welding Aluminum.—M. U. Schoop.—An illustrated description of a new method of autogenous welding of aluminum with the oxy-hydrogen flame and a reducing flux which removes the oxide film always present on aluminum surfaces.—*Electrochem. and Met. Ind.,* April.

Ferrosilicon.—J. Escard.—A continuation of his serial. In the present installment the author describes various methods of making ferrosilicon in the electric furnaces and especially the method of Gin.—*La Lumière Elec.,* March 13.

Units, Measurements and Instruments.

Contacts in Apparatus.—G. J. Meyer.—The first part of an illustrated paper read before the Electrical Society of Berlin. To test the quality of contacts two methods my be used, namely, either the direct measurement of the voltage drop or the measurement of the heat evolved at the contact. The measurement of the voltage drop gives a direct indication of the quality of the contact, but only at the temperature at which the test is made. The test in which the heating of the contact is measured is somewhat affected by the wires in the neighborhood. The measurement of the voltage drop or resistance of the contact is quick and easy, but rather inaccurate. It is advisable to test a number of identical contacts in series. The results of heat tests are best plotted graphically in a diagram which gives the change of temperature with the time. Such curves are very approximately logarithmic curves, if the conditions of the resistances in the apparatus remain constant. The quality of a contact, of course, depends essentially on the smoothness of



FIGS. 5 AND 6.—CONTACTS IN APPARATUS.

the two contact surfaces. The author gives microphotographs showing the difference in structure of cut surfaces when treated either with emery paper and with sand blast. The surfaces may be made smoother by plating with tin or nickel. The resistance of the contact as a function of the pressure of the two contact surfaces upon each other is shown in Fig. 5, in which the ordinates represent the contact resistance in milliohms per square centimeter and the abscissas represent the pressure in atmospheres. Curve I refers to brass contacts treated with emery cloth, curve II to the same contacts treated with sand blast, and curve III to the same contacts treated with sand blast and nickel plated. Fig. 6 gives analogus curves, of which I relates to brass contacts, II to copper contacts and III to brass contacts with insertion of tinfoil. The paper is to be concluded.—*Elek. Zeit.,* March 18.

Condensers of Large Capacity.—G. Schulze.—An account of an investigation carried out in the German Reichsanstalt. The author has investigated the practical behavior of an aluminum electrolytic condenser. The capacity is approximately inversely proportional to the voltage of formation, if one passes from lower to higher voltages. Each electrode when formed at 100 volts has a capacity of 120 microfarads, only one-half, however, being effective. When used with the alternating current at e.m.fs below 90 volts effective, the power factor was about 0.05. At higher voltages the energy losses increase and they also increase when the condenser is in circuit for a longer period. In this case it is advisable to use several condensers in series. When connected to the circuit continually for a week the condenser did not show any visible change.—*Elek. u. Masch.* (Vienna), March 14.

Recording Vacuum-Meter.—An illustrated description of a recording vacuum-meter devised by R. Fuess, and shown in Fig.

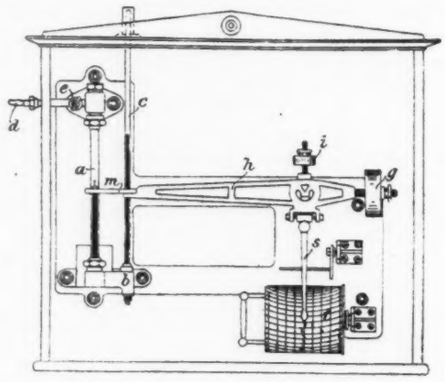


FIG. 7.—RECORDING VACUUM-METER.

7. The two tubes *a* and *c* communicate at the bottom. Mercury is contained in the two tubes to a certain height. There is a "perfect" vacuum in the tube *c* above the mercury, while the top of the tube *a* is connected through *e* and *d* with the condenser or other apparatus the vacuum of which is to be meas ured. The difference of the level of the mercury in the two tubes gives directly the pressure in the condenser, or the level of the mercury in the tube *a* may be used directly for indicating the vacuum. For this purpose a small piece of iron floats on the surface of the mercury in *a*. A permanent magnet *m* surrounds the tube *a* at this place and rises or falls with the mercury in the tube *a*. The magnet *m* is fixed to the arm of the balance *h*, while equilibrium is established by the counterweight *g* on the other arm. The pointer *s* makes the record on the revolving drum *t*.—*Elek. Zeit.,* March 18.

Meter.—An illustrated announcement of the Reichsanstalt by which a single-phase induction meter of the Isaria Meter Works is admitted for calibration.—*Elek. Zeit.,* March 18.

Telegraphy, Telephony and Signals.

Cable Relay.—S. G. Brown.—An account of a lecture held before the Royal Institute in London in which the author explained the limitations which exist in the carrying capacity of submarine cables and the means adopted to extend it. In speaking of receiving instruments, he discussed the syphon recorder of Lord Kelvin and his own drum-cable relay. This apparatus, in addition to enabling clearer signals to be received

at high speeds, can be employed to work various other instruments, through further relay and local circuits, such as punching machines, in which the signals can be automatically punched on a paper strip for further transmission. The apparatus consists essentially of a moving-coil receiver, similar to the syphon recorder, the coil of which carries a long, light pointer. The end of this pointer moves over the surface of a rotating drum, upon which it presses very lightly. The middle part of the surface of the drum, upon which the pointer rests in the zero position, is made of insulating material, and on both sides are metal surfaces with which the pointer makes contact when deflected. The rotation of the drum minimizes the friction, and condensers short-circuiting the contact prevent deleterious effects of the minute sparking that might occur. An inductive shunt in parallel with the suspended coil improves the sharpness of the signals, and a most ingeniously arranged local correction circuit to a great extent obviates the wandering zero by causing correcting currents, sensibly proportional to the disturbing earth currents, to pass through a second winding of the suspended coil. These and other refinements have enabled a considerable increase in signaling speeds to be obtained. In some recent experiments on the Eastern Telegraph Company's cable from Porthcurno (Cornwall) to Gibraltar, the ordinary speed of 140 letters per minute was increased to 240 letters per minute under ordinary duplex traffic conditions, and by special arrangements a speed of 280 letters per minute was reached. Another advantage of the Brown relay system over the ordinary syphon recorder is that considerably less attention is required.—Lond. *Elc. Eng'ing,* March 18.

Telegraphy and Telephony in Germany.—Some statistical notes on telegraphy and telephony in Germany in 1906 and 1907. The number of telegraph stations increased from 34,554 in 1906 to 37,408 in 1907, and the number of towns with telephone exchanges from 28,132 to 30,985; the number of telephone exchanges from 28,218 to 31,086, and the number of telephone connections from 677,088 to 766,247. There is now one telephone exchange for every 1956 inhabitants. The length of telegraph and telephone lines in Germany is 4,527,456 km; of the telephone lines within cities, which have a length of 2,846,356 km, there are 2,200,000 km underground.—*Elek. Zeit.,* March 18.

Telephone Exchange.—A description of a new telephone exchange, with central-battery equipment, which will be opened very shortly in Manchester by the National Telephone Company. A considerable number of subscribers' lines will be changed over from the older central exchange, which is equipped on the call-key system. The general arrangement of the new exchange follows the latest standard central-battery practice of the company, with the addition of a new lamp-flashing circuit on the trunk positions.—Lond. *Elec. Eng'ing,* March 18.

Directed Wireless Telegraphy.—A. Muntell.—A theoretical paper on Zenneck's explanation on directed wireless telegraphy with partly horizontal antennas, and the effect of the earth in this case.—*Phys. Zeit.,* March 15.

Miscellaneous.

Revocation of British Patents.—With respect to the working of the new British patent law, the hearing of the appeal of the British Westinghouse Company against the decision of the Comptroller-General of Patents to revoke the Bremer flame-arc lamp patent is of interest. The Westinghouse Company has abandoned the argument that the lamps were manufactured in that country to an adequate extent to meet the demand, but assert that they have satisfactory reasons—the chief of which is that the period of a license granted to another firm is not yet terminated—for not manufacturing to a larger extent. The respondents assert that this very argument shows that the Westinghouse Company never intended to manufacture the lamps to any considerable degree in that country. The proceedings have been suspended for a few weeks in order to enable the Westinghouse Company to put in further evidence.—Lond. *Elec. Eng'ing,* March 18.

Legislation.—The new Electric Lighting Acts bill proposed for England. It deals with the compulsory acquisition of land for generating stations, the breaking up of streets outside of the area of supply, supply in bulk, supply of electricity to tramways and railways, maximum prices, certification of meters, etc.—Lond. *Electrician,* March 19.

Convention.—The seventeenth annual meeting of the German Association of Electrical Engineers will be held in Cologne from June 2 to 5.—*Elek. Zeit.,* March 18.

NEW APPARATUS AND APPLIANCES

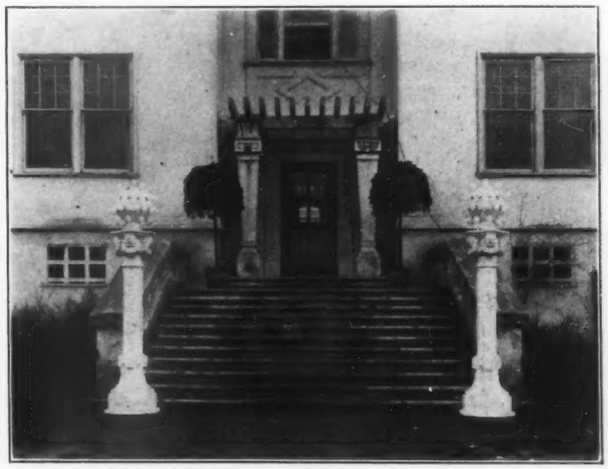
Electric Lighting at the Alaska-Yukon-Pacific Exposition.

By A. J. Quigley.

The electric lighting scheme for use in the main streets and vistas of the Seattle Fair was a problem over which the engineers spent considerable study before any satisfactory solution was found. It was desired to produce an electrolier that would first of all carry the festive idea and at the same time give efficient lighting results at a reasonable cost.

The cut herewith shows two electroliers of the type selected. Over 200 of these will be used on the grounds for the main street lighting. The base or pedestal is made of wood, as well as the support underground and the skeleton frame inside. The remainder, however, is made of staff. Thirty-nine 20-cp lamps are used on the ball, the spacing at the bottom being closer than at the top so as to throw as much as possible of the light downward. Mica molded weather-proof sockets are used in the construction of the ball, these being cast in the staff-work itself so that the lamp practically screws into the ball. A pair of No. 8 feed-in wires tap onto the network of socket wires inside the ball and are carried down through the shaft. The finished result has proved very satisfactory, both as to appearance in the daytime and as to the lighting effect at night.

The electrolier, as shown, can be produced in quantities for about $35, including lamps. Agutter & Griswold Company, electrical contractors, of Seattle, were the successful bidders on both the underground feed-wire system and the electroliers



ELECTROLIERS, ALASKA-YUKON-PACIFIC EXPOSITION.

and have now about completed these contracts. By April 1 current can be turned on the whole system—10 months ahead of the opening date of the fair.

Steel Service Boxes.

Illustrated herewith are new service boxes designed by the J. Lang Electric Company, of Chicago, to combine a main switch, main fuse, meter loop and panel board in one panel and cabinet. The object is to do away with the necessity of two separate boxes, reducing the number of connections and

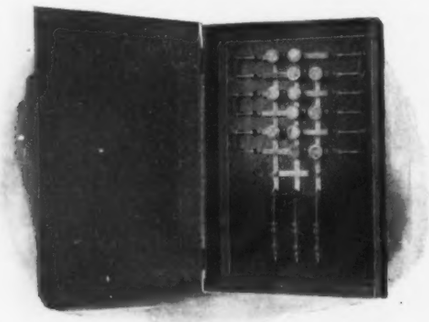


FIG. 1.—SERVICE BOX.

simplifying the installation. The "Universal" service box, as it is called, is particularly useful in small installations such as residences, apartment buildings, small stores, etc. It can be used on a two-wire, 110-volt system or on a three-wire, 250-125-volt system. Means for converting from one system to

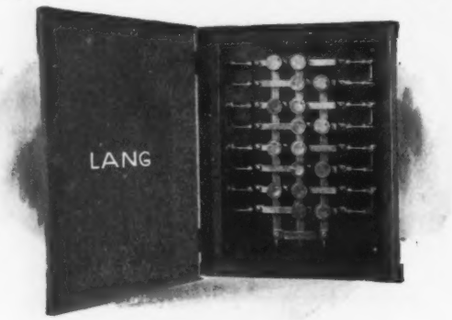


FIG. 2.—SERVICE BOX.

another are provided on every panel. Fig. 1 shows the style "S G" service box. It is a "Universal" panel board with switches in the branches, fused switch and a meter loop in the mains.

Fig. 2 illustrates the style "T G" steel service box with switches in branches and terminals only in mains. Each steel

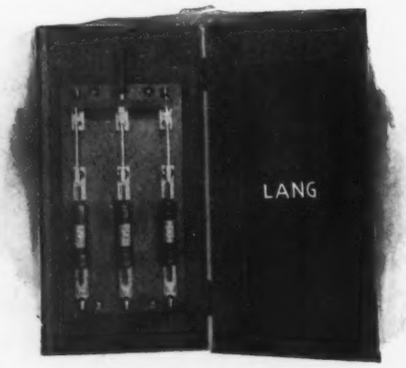


FIG. 3.—SERVICE BOX.

box is furnished with three knockouts for ½-in. conduit in each end and knockouts for ½-in. conduit along the sides, 5⅛ in. apart. The boxes are constructed of No. 16 gage sheet steel.

In Fig. 3 is shown a service box containing a Lang "Paragon" knife switch, with plain finish and spaced for 250 volts. Boxes for 25-amp to 100-amp switches are 3½ in. deep. Those for 150 amp to 200 amp are 5 in. deep. Boxes may be furnished with fuse extensions under the handle end. The doors may be closed with the switch open or closed.

Electric Curling Iron.

Mr. Herman Bollin, of Chicago, with the co-operation of Mr. J. L. Burgard, has invented an electric curling iron that seems to have several meritorious features. Both parts of the curling iron are supplied with heating elements. The wooden handles are hollow, and, as shown, the flexible cords from an incandescent-lamp socket lead through them to the metal parts. Either direct or alternating current at 110 to 116 volts may be used. The resistance wire in the jaws is said to be so designed that on application of the current the temperature of both parts

ELECTRIC CURLING IRON.

of the iron increases to about 375 deg. Fahr. in about one minute, and remains constant at that temperature. There is claimed to be no danger of burning the hair, and in using the device no odor of singed hair is perceptible. The use of the electric iron results in a great saving of time compared with alcohol or gas-heated tools. The device is also safe in the hands of the inexperienced and occupies little space so that it can easily be packed in a trunk or suit-case. The metal parts are finished in nickel and the heated portions can be renewed easily if necessary.

Deltabeston Magnet Wire.

Since Deltabeston magnet wire was first placed upon the market every effort has been made to improve its qualities. Only the purest fiber is used in the insulation which is so treated that the wire is claimed to be absolutely indestructible so far as any temperature rise to which it may be subjected in actual service is concerned. In addition to being heat-proof, the wire is also made water-proof by thoroughly impregnating the insulation with a compound which prevents any absorption of moisture. Recently tests were made to compare the properties of this wire with those required and covered by the United States Government specifications. The specification reads in part as follows:

"When subject to a temperature of 160 deg. C., neither the asbestos covering nor the water-proof compound shall be injuriously affected. Six-in. samples of wire with carefully paraffined ends shall be immersed in fresh water at a temperature of 22 deg. C. for a period of 24 hours. The per cent of water absorbed by the insulation during such immersion shall not exceed 4 per cent." These tests more than fulfilled the requirements, and a contract was awarded to the D. & W. Fuse Company as a result.

Automatic Motor Starters.

Motor starters with no fixed time element have found favor with engineers by reason of the protection afforded the motor in starting. The time required for bringing a motor to full speed should be in direct proportion to the load to be started, or, better still, the current should have a fixed value throughout the starting operation. To obtain this result series relays have been used in connection with various types of solenoid starters. Voltage magnets controlled by the counter e.m.f. or by the drop in line voltage have also been used with success in some types. The Monitor automatic starter illustrated herewith makes use of the armature current itself as the governing element, and the resistance steps cut out successively as the current falls off. By this means the armature current during the starting operation is limited to a predetermined value and no overload device or series relay is required to protect the motor from overloads. The method of control is novel and is protected by patents.

Fig. 1 shows a 10-hp motor starter with four sections of resistance. The small solenoids shown are all in series with the motor armature and are compounded so that they can only cut out in their proper order. The compounding is controlled by the main contacts and there are no auxiliary contacts or cut-outs on the starter. The action of the starter is as follows: When the motor switch is closed, the four-step magnets and the master magnet, which is also in series, are energized. The master magnet removes the mechanical support from the cores of the small solenoids which carry the contacts. As the motor speed increases the current falls off until the first solenoid is weakened enough to drop its core, closing the contact. This contact cuts out a section of resistance, the solenoid itself and part of the second solenoid. With the cutting out of resistance the current increases slightly and again falls off as the motor speeds up, permitting the second contact to close. In the same manner the third and fourth contacts close in order, completing the operation. In the larger sizes a carrying switch, also worked in series, short-circuits the entire starting device after the last contact closes and carries the current on laminated contacts. The mast magnet also serves as a no-voltage release, returning to the starting position instantly when the current is cut off. It is claimed by the manufacturers that it will always bring the motor to full speed in the shortest time consistent with the load, but always with a safe limitation of the armature current. The starter will not pass more than the predetermined amount of current to the motor at any time during the starting operation, no matter what the load may be. The starter is in no way affected by atmospheric or climatic conditions. The rheostat is of non-corrosive metal with

FIG. 1.—10-HP STARTER.

negligible temperature coefficient. The contacts are of graphite and copper, and no sliding or rubbing contacts are used. No dash-pot or mechanical retarder is used and the construction is simple and rugged throughout. By reason of its simplicity, rugged construction and certainty of action under all conditions the starter is claimed to be fool-proof. No carelessness or inattention can possibly result in throwing a motor on the line until it comes up to speed. The Monitor Manufacturing Company also makes a line of reversing elevator controllers, both for electric and manual control, making use of the Monitor starter. The line of printing-press controllers is very complete, covering all sizes from the small job press to the largest rotaries, and has a number of novel features. Fig. 2 shows a push-button controller with dynamic brake, armature and field control, locked speed device and adjustable solenoids. The locked speed is a new feature and has found favor with print-

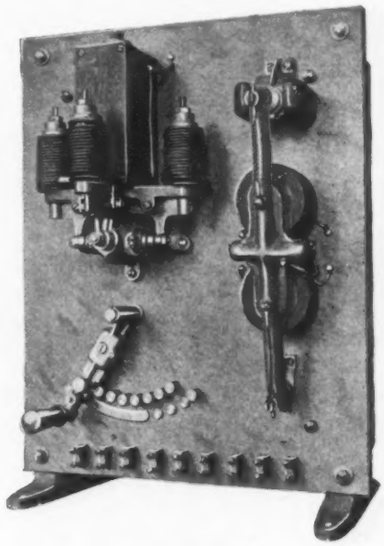


FIG. 2.—PRINTING PRESS CONTROLLER.

ers, as the speed can be set and locked at any point, and the motor returns to the given speed each time it is started, insuring uniform speed throughout the running of a job. The adjustable solenoids have a wide range and are set to give the press a perfect start by cutting out at a point close to the running load. The development of the apparatus has extended through several years, and the apparatus has been thoroughly tested in service. The sales are controlled by the Monitor Sales Department, Baltimore, Md.

Philadelphia House-Furnishing Show.

At Horticultural Hall, Philadelphia, from March 29 to April 3 inclusive, there was held what was called the Second House Furnishing Show. A number of exhibits were made, among them being that of the Philadelphia Electric Company, which occupied 20 spaces, and included an exhibit of the latest utensils for electric cooking and heating in actual use. Another feature was a display of electric laundering appliances, such as pressing irons, electric washers and wringers.

The Sanitary Electric Cleaning Company, of Philadelphia, showed a line of "Invincible" electric renovators, for which they had the local concession, and the Electric Suction Sweeper Company, of New Berlin, Ohio, showed the Hoover electric suction sweeper, in connection with demonstrations in various sorts of cleaning. The Keller Manufacturing Company, of Philadelphia, exhibited the "Santo" cleaner, which it claims is absolutely safe to use where there are children, as all the machinery is enclosed, and there are no revolving parts to injure the furnishings. Robbins & Myers Company, Springfield, Ohio, exhibited a full line of its standard fans, including all the popular types of ceiling and desk fans, alternating-current oscillating fans and 9-in. household fans; also, a complete line of motors in more than 30 sizes, ranging from 1/30 hp to 15 hp.

Device for Interrupting the Circuit on an Excess Load.

The indicator manufactured by the Excess Indicator Company, of Lynn, Mass., is intended primarily for lighting circuits, its function being to open and close the circuit whenever the load under contract has been exceeded. This causes the light to flicker until the excess load has been turned off. The foundation of the instrument is a heavy slate base, upon which

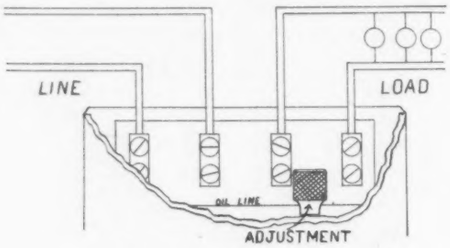


FIG. 1.—TWO-WIRE CONNECTIONS.

a magnet with series and shunt coils is mounted. The coils have laminated cores, the shunt core being connected with a heavy double-pole switch. The series coil, which is placed above the shunt coil, and in a three-wire circuit is doubled, has a stationary core. Set upon an adjustable pinion is a heavy clock spring, which is attracted by the series coil whenever the

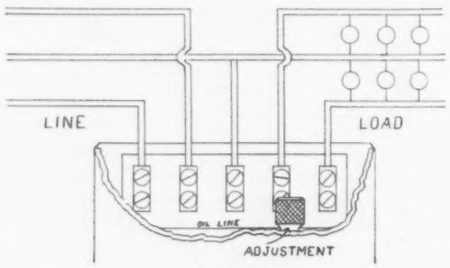
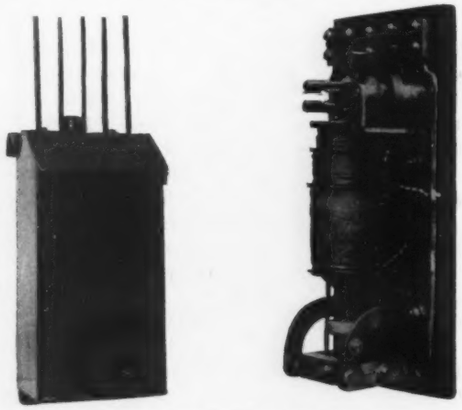


FIG. 2.—THREE-WIRE CONNECTIONS.

current passing is sufficient to cause the magnet to overcome the tension spring. The series coils are balanced so as to attract the spring whenever either side of the circuit is overloaded. A hard fiber pinion is provided for adjustment. This is accomplished by turning the pinion in a counter-clockwise direction, so as to reduce the tension upon the spring. A re-



FIGS. 3 AND 4.—EXCESS INDICATOR WITH AND WITHOUT CASE.

verse motion increases the tension for a greater load. The contacts for the shunt circuits are made of coin silver. The mechanism is immersed in transil oil, which tends to keep all of the parts properly lubricated, and the circuits being broken in this oil sparking and wearing of the contacts is eliminated. Provision is made for outside connection with heavy brass binding posts. This connection may be made after the instrument has been set up, and any readjustment effected without disconnecting the device. The whole is enclosed in a substantial cast case, which can be sealed to prevent interference. The range of the adjustment of the instrument is said to be great, considering the delicacy of its operation. The device, it is claimed, will operate equally well on a load of ½ amp to 10 amp, and the adjustment can be made within 10 per cent of any predetermined demand. The designs provide for two- and three-wire instruments on direct current, and also for instruments for alternating current on any frequencies from 25 cycles to 133 cycles. The apparatus is built for currents up to 500 amp.

Electric Grab-Bucket Hoist.

The Sprague Electric Company, of New York, has brought out an interesting electric grab-bucket hoist applicable for lifting any loose material such as coal, coke, sand, broken stone, etc. The bucket, which may be of the clam-shell or orange-peel type, is operated by three ropes, two of which are anchored to one drum and are called the holding ropes, and one of which is anchored to the second drum and is called the lacing rope. The two holding ropes serve to hold the bucket when it is digging and dumping and also prevent it from spinning around. The lacing rope is used to close and open the bucket. All three ropes hoist the load. The action of this type of bucket hoist is clearly shown in the engravings, when the bucket is shown shut and in its uppermost position.

Three motors are employed: a hoisting motor, a lacing motor and a traversing motor. In the hoist shown these are rated at 10 hp, 15 hp and 10 hp, respectively. The bucket is operated

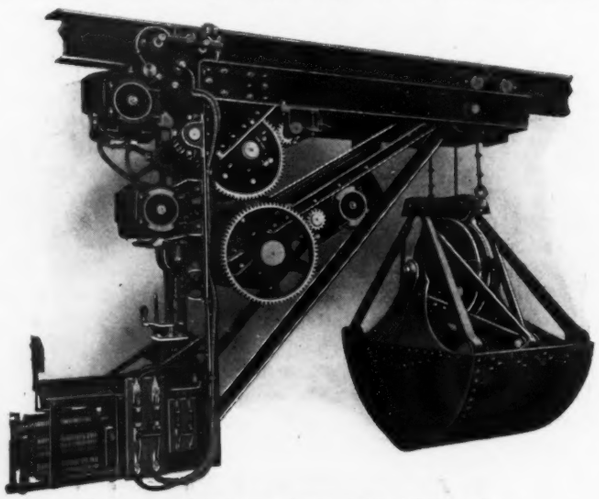


FIG. 1.—ELECTRICALLY DRIVEN GRAB-BUCKET HOIST.

without the multiplicity of levers and clutches often found, the control being accomplished by means of one controller handle, the connections of which are shown diagrammatically in Fig. 4. Two controllers are mounted back to back and the drums geared to be turned from one handle, which also prevents the slackening of either rope at any time or the overhauling of one rope faster than the other, which might in either case result in damage to the machinery. The controller, which is shown with eight steps, is of the cylindrical type and so arranged that the handle may be revolved continuously in one direction, thus enabling the operator to reach any desired point quickly from the "off" position.

The operation is as follows: Suppose the bucket to be dropped into the material which is to be raised. The controller handle is turned so that the fingers make contact in line 1, closing the circuit through the motor on hoist *A*, overhauling the closing rope and thus closing the bucket. At the same time the circuit is closed through the motor of hoist *B* with enough resistance in circuit to keep the current down so that the motor pulls just hard enough on the rope to keep it taut. As soon as

the bucket is closed the controller handle is turned so that the fingers make contact on line 2, thus cutting out part of the resistance from the motor circuit on hoist *A*, causing it to start the bucket slowly while the hoist *B* is still keeping its rope taut, following the speed of the closing hoist *A* automatically.

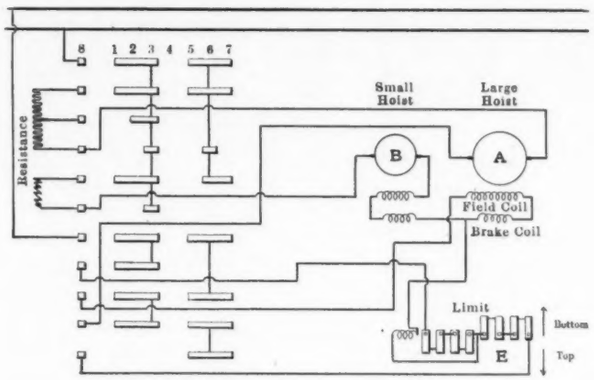


FIG. 2.—CONTROLLER CONNECTIONS.

The controller handle is now turned to step 3, which cuts all the resistance out of circuit of both motors, thus lifting the bucket at full speed, the closing hoist *A* being assisted to a certain extent by the hoist *B*, but not enough to cause the bucket to open. As soon as the bucket has reached the desired height the controller handle is turned to step 4, open-circuiting both motors, allowing the brakes to be applied and bringing the bucket to a stop. Should the operator through negligence allow the hoist to continue, the circuit is automatically opened on both hoists by a limit switch. The handle may now be moved to step 5, which reverses the closing hoist with all the resistance in circuit. Motor *B* being open-circuited the holding rope is held while the rope *A* is slackened off, which action allows the bucket to open and dump its load. The step 6 cuts out all the resistance in series with the closing motor, allowing it to lower rapidly and closing the circuit through the motor *B* in the same direction as it was before, but with so much resistance in circuit that a very small current is allowed to pass, thus causing the motor to exert enough pull to hold the bucket open. As soon as the bucket has reached the material to be moved, motion on one of the hoists is stopped by turning the handle to "off" through position 7. This last step is provided for slowly lowering the load without opening the bucket if it is desired to do so and is the same as step 6, but with resistance in circuit with the motor *A*. In all the operations described it will be noted that while motor *B* is in circuit the current is passed always in the same direction—that is, tending to cause the motor to hoist, the variation in pull being accomplished by varying the amount of resistance in series with the motor.

Another advantage is that the limit switch *E* is so connected that it breaks the circuit of both motors when the bucket has reached the upper or lower position for which the limit is set. The switch is resetting, and after it has opened in one direction it does not prevent the hoist being operated in the other direction.

The operator's cage, which may be open or enclosed, carries

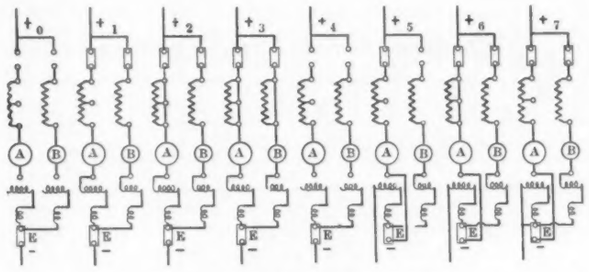


FIG. 3.—CONTROLLER CONNECTIONS.

the controllers, grid resistance, switches and fuses. The trolley carriage travels on an I-beam. The brakes are applied with a spring and released by solenoid coil and plungers, the coils being connected in series with motors, thus insuring their action in case of failure of either the motor or the main circuits.

Series, steel-frame, crane motors are employed, fitted with removable pole pieces, box-type brush holders, etc. The bucket is rated at 1½ yd. and the lift is 50 ft. The hoisting speed is 150 ft. per minute and the traversing speed 350 ft. per minute. The type of electrically driven grab-bucket hoist, which is shown in Fig. 1, is also made for alternating-current motors.

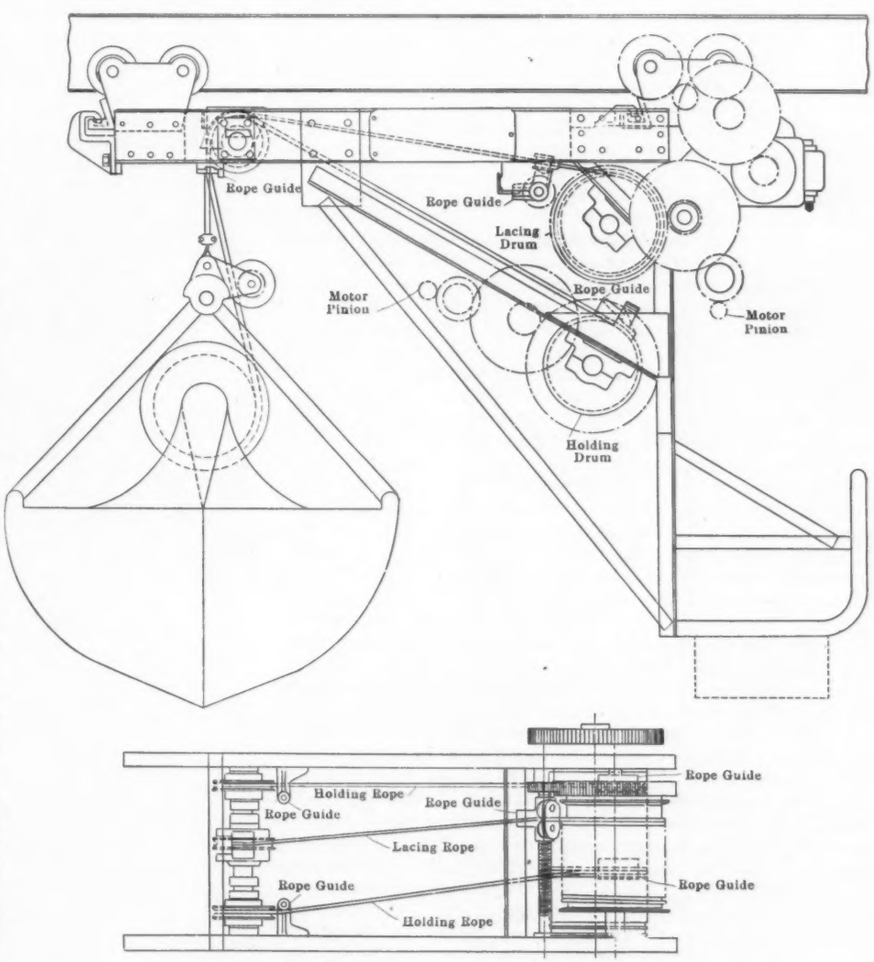


FIG. 4.—SIDE ELEVATION AND PLAN OF HOIST.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Trade conditions continued to be irregular throughout the country during the past week. There has been little evidence of improvement, although there is a growth of optimistic feeling, which is due, no doubt, to the promise that the tariff matter will be speedily settled, and that the spring weather is bringing about an access of retail business. The Easter season has been up to the average, according to the reports from the West, and retailers are in consequence fairly well sold out. Current demands upon jobbing houses and wholesalers are, of course, light, as this is, at the best, an inter-season period. The orders that are received are mainly for filling in, or for rush delivery. The crop situation throughout the country is reported to be entirely satisfactory, and there is every reason to believe that an abundant yield will be realized unless the weather conditions are abnormal. In the industrial world there is little to report in the way of improvement. The iron and steel business is still dull, although some contracts have recently been made for structural material. Competition, however, in this line is keen, and prices are very low. Pig iron is dull, even at the low level of present prices. Orders for bars, plates and rails are very small, and the equipment manufacturers report little new business. Wage reductions are more frequently reported, and there is still talk about a sweeping cut by the United States Steel Corporation. So far strikes have not been frequent, and there seems to be a disposition on the part of wage-earners to bear their share of the present depressed condition of business. In cotton and woolen goods there is some increase of activity, especially in the yarn trade. Immediate orders for finished goods are not very much more active, but inquiries indicate that stocks are very light throughout the country. The failures for March as reported by *Bradstreet's* for the first quarter of the year 1909 are fewer than for last year, and the liabilities are lessened. During the first quarter there were 3312 failures, which is a decrease of 21 per cent over the number last year. The liabilities are 64 per cent less. Failures for the week ended April 1 were 204, against 226 the week previous, 247 in 1908, 137 in 1907, 155 in 1906 and 170 in 1905.

THE COPPER MARKET.

In spite of the very much more hopeful tone in the copper market and the recent advances in quotations, there has been in reality little improvement either in the demand or in the satistical position. The passing flurry of interest in Standard warrants in London was enough to cause the American producers to put up prices immediately and also to stimulate exports and local buying for the moment. The interest, however, was transitory and local consumers have not seriously come into the market for the very simple reason that orders for finished material continue to be distressingly light. Producers and selling agencies persistently declare that the copper situation has materially improved; possibly it has, but it does not look as yet as if the condition were one to grow hilarious over. The accumulation during the month will probably exceed that of February. The output from domestic ores will amount to about 90,000,000 lb., the imports will be near 25,000,000 lb., making a total for the month of 115,000,000 lb. The exports for the month were 42,000,000 lb. and the domestic takings at the outside were not more than 50,000,000 lb. Thus the total disposed of copper was not more than 92,000,000 lb. during the month, while the known production was 115,000,000 lb., leaving an accumulation of 23,000,000 lb. This added to the figures of the Copper Producers' Association, which are known to be ultra conservative, brings the present stock of "marketable" copper to almost the 200,000,000 lb. mark. In spite of these figures there is no movement on foot to curtail production, nor is such an effort probable unless the carrying burden becomes much heavier than it is at present. The cost of shutting down the properties of the principal producers is too great to make such a course preferable to operation at a loss. At Butte, for instance, the maintenance cost during a shut-down is estimated at $300,000 per month. On April 5, the last day under review, there was renewed pressure to sell, but only small lots were disposed of. Prices remained officially unchanged, but there is a general understanding that round lots might be secured a shade under quoted figures. The exports for March were 20,824 tons, and for the present month up to and including April 5 have been 2,144 tons. Quotations on the Metal Exchange April 5 were:

Lake	12⅜ @ 13
Electrolytic	12½ @ 12⅝
Castings	12⅜ @ 12½

London prices April 2 were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	57 6 3	57 7 6
Standard copper, futures	58 0 0	58 0 0
Market	Steady.	Quiet.
Sales of spot		100 tons
Sales of futures		1,000 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	.....	.....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Castings	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

THE TARIFF RATE ON ARC-LIGHT CARBONS.—The importers of ordinary electric light carbons are, as a rule, very well satisfied with the proposed change in the tariff as contained in the Payne bill. The importers of flaming-arc carbons have, however, made a strenuous protest to Washington, claiming that the new duty will increase the rate 50 per cent, and the National Carbon Company, the only American manufacturer, has made earnest efforts to have the old tariff remain. The main imports of carbons are those for inclosed arcs, and it is claimed by the importers that the new tariff will reduce the price of these to consumers from $5 to $8 per thousand. Speaking of the change in rate, one of the most prominent of the importers said: "We will be perfectly satisfied with the new bill. It will not only open up to us competition in enclosed arcs, but it may even permit us to compete for the very cheap grade of copper-covered carbons used in open-arc lamps. Heretofore the importation of these carbons has been impossible, owing to the $9-per-thousand rate of duty. The result has been that the American consumer has been charged several times the price that would be a reasonable profit on their manufacture. Heretofore we have been unable to sell carbons for enclosed-arc lamps to any large consumers, because the carbon manufacturers in this country were always willing to cut prices on big orders below the figure at which we could import, even when we imported in double lengths. It is claimed by some that the new tariff rate will vastly increase the duty on flaming-arc and searchlight carbons. These are very high-priced materials, and, of course, 35 per cent ad valorem will amount to much more than $9 per thousand." One of the principal importers of flaming-arc lamps and carbons has written a letter to Senator Aldrich calling his attention to the hardship to the flaming-arc industry if the proposed tariff is adopted. It is pointed out that the flaming-arc industry is new in this country and that the carbons are almost all imported. The proposed tariff, it is claimed, would increase the duty 50 per cent, seriously crippling the industry without protecting any industry. It is suggested that flaming-arc carbons be made an exception in the paragraph relating to carbons and that they be put on the free list.

ELECTRICAL SUPPLIES FOR PANAMA CANAL.—The Isthmian Canal Commission will receive in Washington, up to April 15, proposals for considerable quantities of supplies for electrical transmission lines on the Panama Canal work. Lead-covered cables, all kinds of insulated wire, joints, connections, insulators, switches, lightning arresters, etc., are included in the advertisement. Full specifications will be sent upon application to the commission's purchasing department.

CROCKER-WHEELER COMPANY. — The Crocker-Wheeler Company reports that business booked during March showed improvement over the February bookings. The demand was largest for direct-current machinery. The greatest improvement was shown in motors for the printing trade and the steel industry, although all classes of business show some improvement. During the past week an order was received for 350 hp of rolling-mill motors for the West Penn Steel Company, Breckenridge, Pa., and a 250-kw direct-current machine was added to the large power plant already installed at the Northwestern Terra Cotta Company, Chicago. A 50-kw generator, to be driven by a DeLaval steam turbine, was ordered for lighting and power for the McCahan Sugar Refining Company, Philadelphia. Another large order recently booked is for 14 three-phase, 60-cycle squirrel-cage induction motors, aggregating 220 hp, for Johnson & Johnson, New Brunswick, N. J. Other recent induction motor sales are those for 160 hp of the wound rotor type for the Buffalo Copper & Brass Company, of Buffalo, and a 20-hp for the Frick Company, Waynesboro, Pa. The Eastwood Wire Manufacturing Company, Belleville, N. J., has ordered a 250-kw engine-type direct-current generator, and the Atlantic Hotel, Bridgeport, Conn., has purchased a 35-kw similar machine. A large rolling mill near Pittsburgh has placed an order for 244 hp of direct-current motors of the rolling-mill type. Other direct-current sales are those of 20 motors for the Lanston Monotype Machine Company, Philadelphia; a 75-hp motor for the W. W. Herron Lumber Company, Mobile, and six motors for the F. P. Little Electric Company, Buffalo. The Denver office of the company recently ordered a number of small 230-volt direct-current motors which will be installed in the plant of the Cox-Clark Engraving Company, Denver. The motors will be used for individual drive on engraving and electrotyping machinery as follows: A 3-hp motor driving a planer; a 1-hp motor driving a router; a 1-hp motor driving a saw; ½ hp each on a trimmer, a beveler and a tub rocker, and a ½-hp motor driving a jig-saw and drill.

AMENDMENTS TO MICA SCHEDULE.—One of the amendments to the proposed tariff bill which has been admitted by the Ways and Means Committee, provides that crude mica shall pay a duty of 5 cents per pound and 20 per cent ad valorem, and that manufactured mica shall pay a duty of 10 cents per pound and 20 per cent ad valorem. Under the present law these rates are 6 cents for crude and 12 cents for manufactured, the ad valorem duty being the same. The Payne bill proposed that the duty on mica should be 30 per cent ad valorem, which included crude mica and trimmed, or partially manufactured, mica. Mica plates to be admitted at 35 per cent ad valorem. These plates came in heretofore under the heading of manufactured mica, paying 12 cents and 20 per cent ad valorem. These proposed amendments are said to be the direct result of the urgent protests of the North Carolina mica mining interests. This section furnishes the majority of the mica mined in this country, and the mine owners claim that a duty of 30 per cent meant the destruction of their business. Importers declare that they would much prefer that the duty should be what the Payne bill proposed than what is proposed in the new amendments. They claim that the rates in the Payne bill would cheapen very materially the mica used in the electrical industries, whereas the specific and ad valorem duty proposed in the amendments will make very little difference from the present rate. The majority of the mica used in the electrical industries is, they state, of the cheaper grade, running from 12 to 25 cents per pound. Ninety per cent of this mica comes from India or from Canada. It is said that American mica is, as a general thing, unsuitable for use in electrical machinery.

WESTINGHOUSE ORDERS BETTER IN MARCH.—The orders received by the Westinghouse Electric & Manufacturing Company during the month of March are reported to have increased about 30 per cent over the previous month, thus making March the best month so far this year. None of the orders was exceptional in size. It is reported that the number of inquiries and invitations for tenders of new work are unusually large, giving every prospect for a continuous increase. Work on the $5,000,000 order from the Pennsylvania Railroad for the electrification of the New York Terminal is progressing rapidly. It is stated that within the next week or so the Pennsylvania Railroad will be ready to issue orders for the construction of the substation apparatus for Manhattan and Long Island City. As there will be several of these substations built, the electrical equipment, consisting of rotary generators, transformers and other auxiliary apparatus, will amount to considerable, all of which will add to the activity at the Westinghouse plant. The month of March has also been a very good one with the Westinghouse Machine Company. The first quarter, however, has always been considered especially good in the machinery business, because orders are then placed for early fall delivery. But while the usual increase has been noticeable, it is observed that the quota of orders this year has not been made up as heretofore by contracts received from the large consumers; on the contrary, the orders received, for March particularly, were of very ordinary size, not one being larger than $60,000.

THE ALUMINUM TRADE.—At a meeting recently held in London, the shareholders of the Aluminum Corporation, Ltd., decided to appoint a liquidator for the voluntary winding up of the company. The British Aluminum Company, Ltd., had made an offer to purchase the property and interests of the corporation, but the shareholders preferred a different method of liquidation. The Aluminum Corporation was formed in 1907, with a nominal capital of $2,500,000, and at once began to build extensive works in North Wales. Construction work was pushed and the machinery and plant were installed with a view to an output of 1000 tons of aluminum per year. The failure of the company to succeed in financing its undertaking leaves the plant in an unfinished condition. One part of the equipment of the plant that was particularly interesting was the use that had been made of aluminum for providing the large-scale electrical fittings. The activity of this company has done much to stimulate the use of aluminum for electrical purposes in England. Trade in that direction is better than it has ever been in the history of the metal. In this country there is little being done at the present time in the aluminum business. Few sales are being made, and the prices are about where they have been for the past six months, from 20 cents to 23 cents per pound. In England the price at the present time is £60 per ton or about 14.6 cents per pound.

KENSINGTON & EASTERN RAILROAD.—The Kensington & Eastern Railroad Company has been granted a franchise by the Chicago City Council authorizing it to construct and operate a four-track electric railway from 115th Street, Kensington (a suburb of Chicago), in a southeasterly direction to the south city boundary of Chicago just east of Howard Avenue. Beyond the city limits the line will be built for a short distance in Cook County, Illinois, and at the Indiana State line it will connect with the Chicago, Lake Shore & South Bend Railway, an important interurban railway extending to South Bend, Ind. The road is to be electrically operated (although steam-hauled trains may use the same tracks), and permission for overhead construction is granted. It is stipulated that in Chicago no wires shall cross any street, alley or public place at a height less than 21 ft. 6 in. above the track of the railway. The duration of the franchise is 20 years, and the rate of fare within the city limits shall not exceed 5 cents. One provision of the ordinance is that at least 80 per cent of the electric trains on it shall stop at such places within the city limits for local passengers as may be designated by the City Council, provided the distance between these stations is not less than one-quarter of a mile. At Kensington the road will connect with the suburban service of the Illinois Central.

NEW HAVEN RAILROAD PREPARES ELECTRIFICATION PLANS.—It has practically been admitted by the officials of the New York, New Haven & Hartford Railroad that preliminary work has been done on plans looking to the electrification of that division of the road between Stamford and New Haven, Conn., and the construction of an additional large power house at Naugatuck Junction, where a site has been secured. An official of the New Haven admitted in testifying in a smoke-nuisance case that such plans were under way. It is now stated that W. S. Murray, electrical engineer of the railroad, has perfected his plans for the power house, and is preparing plans for the electrification. These plans are now being considered by the officials of the road, but nothing has yet been definitely given out concerning them. At the offices of Westinghouse, Church, Kerr & Company, the engineers who constructed the power house at Coscob, Conn., it was said that no instructions to prepare plans had been turned over to that firm by the railroad company. It is claimed that the extensive tests which have been made upon the operation of trains by electricity have convinced the officials of the railroad that it will effect a material economy.

WESTERN UNION'S BUSINESS IMPROVED.—The officials of the Western Union declare that the volume of business at the present time is the largest that the company has had since the operators' strike, more than a year ago, and that it nearly equals the high record of normal periods. It is also stated that the operating ratio is lower than ever before, a condition which will materially benefit the net earnings.

NEWARK TECHNICAL LIBRARY.—The Free Public Library of Newark, N. J., has established a technical and scientific department in order to meet the needs of the working man and student. In addition to large collections of technical books and periodicals, trade catalogs are kept on file, and also the United States, English and Canadian Patent Office publications. The list of electrical books already exceeds 700 titles.

HALL SIGNAL COMPANY.—Reports made by officials of the Hall Signal Company show that the demand from the railroads and traction companies for signal equipment during the month of March was much larger than for any month since the beginning of the period of depression. The company's operations are now 50 per cent of full capacity, which is twice what it was this time last year.

Financial Intelligence.

THE WEEK IN WALL STREET.

The stock market during the past week has been very much more active than during any week since the first of February, and the buoyant feeling that has been observed even during the days of dull trading became very much more prominent. Most of the active issues recorded material advances during the week, and some of them on April 5 recorded new high figures for the year. Steel common has been exceptionally strong, and the Harriman securities have been prime favorites among both speculators and investors. While the general condition commercially and industrially has not improved to a very marked degree, the impression seems to have suddenly obtained that the bottom has been reached, and that from now on only good news would be forthcoming. This sentiment, backed by the fact that railroads are increasing in earnings every week, was sufficient to make the market strong. The upward movement was no doubt started by the liberal buying of American securities in London. On more than one occasion this has been the start of an upward trend to our stock market. It is claimed that there was a considerable short interest in the Street, and that this was forced to cover, thereby adding to the upward tendency of prices. It is doubtful if there is any short interest at the present time that is serious enough to cause trouble. Political conditions in Europe during the past week were very much improved, and it is now practically assured that there will be no Balkan war. This in itself has a strengthening influence in our market. The money market remains very strong, both in this country and in Europe. There seems to be an abundance of cash in the banks on both sides of the ocean, and rates for first-class loans continue to be very low. The gold shipments of this country to Europe during the past year have amounted to about the same amount as was drawn from Europe immediately subsequent to the panic of 1907. Imperial banks abroad are particularly strong in gold, and this country has all that it requires. The bond market, while not as active as formerly, is still very satisfactory, and several issues that were put out during the past week were immediately subscribed. Rates for money April 5 were: Call 1½@2 per cent, 90-days 2½ per cent. The quotations in the table are those of the close April 5.

NEW YORK.

	Mar. 27.	Apr. 3.	Shares Sold.		Mar. 27.	Apr. 3.	Shares Sold.
All.-Ch.	14⅜	15⅛	7,850	Int.-Met., pfd..	40	43⅞	94,100
All.-Ch., pfd...	45⅞	47⅜	9,850	Mackay Cos...	73½	74¼	830
Amal. Cop. ...	74⅜	77⅛	193,260	MackayCos.,pfd.	71¼	71	1,535
Am. D. T.....	35*	29*	——	Manhattan Elev.	144	144*	363
Am. Loc.	54¼	56	10,100	Met. St. Ry....	21*	25	200
Am. Loc., pfd...	114*	114⅞*	200	N.Y. & N.J.Tel.	117¼*	119½	305
Am. Tel. & Cbl.	76½*	76*	100	Steel, com.....	47⅛	51½	703,725
Am. T. & T...	132¼	131⅞	28,000	Steel, pfd.....	112⅛	113⅞	26,070
B. R. T.....	74⅝	77⅜	142,470	W. U. T.....	56⅜	67	1,100
Gen. Elec.	157½	159⅜	5,000	West'h., com...	83⅜	84½	5,007
Int.-Met., com..	13	14⅞	33,750	West'h., pfd..	115*	115*	——

PHILADELPHIA.

	Mar. 27.	Apr. 3.	Shares Sold.		Mar. 27.	Apr. 3.	Shares Sold.
Am. Rys.	45¾	46	——	Phila. Elec. ...	11⅞	11¾	——
Elec. Co. of A.	12½	12½*	——	Phila. R. T....	28⅞	29⅞	——
Elec. Stor. B'ty	46½	44¾	——	Phila. Traction.	92½	92½*	——
E. S. B'ty, pfd.	49*	49*	——	Union Traction.	54⅞	55⅜	——

CHICAGO.

	Mar. 27.	Apr. 3.	Shares Sold.		Mar. 27.	Apr. 3.	Shares Sold.
Chi. City Ry...	187*	187*	——	Chi. Tel. Co...	132¼	133*	——
Chi. Rys., Ser.1.	110*	110*	——	Met. El., com..	19*	19*	——
Chi. Rys., Ser.2.	40¾*	41*	——	Nat'nal Carbon.	85½*	84	——
Com. Edison...	111½	112*	——	Nat. Carb., pfd.	119*	119*	——
Chi. Subways...	27½	27½*	——				

BOSTON.

	Mar. 27.	Apr. 3.	Shares Sold.		Mar. 27.	Apr. 3.	Shares Sold.
Am. Tel. & Tel.	132⅛	131⅞	——	Mex. Tel.	2¾	3	——
Cum. Tel.	126¼	128*	——	Mex. Tel., pfd.	6⅝	6*	——
Edison El. Ill..	254	258¼	——	N. E. Tel.	132½	132½	——
Gen. Elec.	158	160	——	W. Tel. & Tel.	7*	7*	——
Mass. Elec. Ry.	15	14¾	——	W. T. & T., pfd	77	75⅞	——
Mass. E. R., pfd	72½	72¼	——				

*Last price quoted.
Shares sold are for week March 29 to April 3.

DIVIDENDS.

Brooklyn City Railroad Company, quarterly, 2½ per cent, payable April 15.

Cincinnati, Newport & Covington Light & Traction Company, preferred, quarterly, 1¼ per cent; common, ⅞ per cent, both payable April 15.

Mexican Light & Power Company, quarterly, 1 per cent, payable April 15.

Radio Telephone Company quarterly, 1 per cent, payable April 15.

Southern New England Telephone Company, quarterly, 1¼ per cent, payable April 15.

INTERNATIONAL SMELTING & REFINING COMPANY.—The organization of the recently incorporated International Smelting & Refining Company has been effected by the election of John D. Ryan, president, and Dennis Sheedy, Denver, vice-president. In addition to these the following directors were elected: Urban H. Broughton, Charles E. Brooker, Thomas F. Cole, Adolph Lewisohn, E. C. Converse, Thomas Morrison, of Pittsburgh; C. A. Congdon, of Duluth; Charles H. Sabin, Denver; William D. Thornton and Charles F. King. J. W. Allen was elected secretary and treasurer. The authorized capital stock of the International company is $50,000,000, but only $10,000,000 will be issued at the present time. The company has purchased from the United Metals Selling Company the refinery operated at Perth Amboy, N. J., under the title of the Raritan Copper Company. This is the largest refinery of its kind in the world and has a capacity of 26,000,000 lb. per month. A new smelter is being constructed by the company in Utah which will be in operation by Jan. 1, 1910, and will have a capacity, to start with, of 2000 tons a day. This smelter will be built on the plan of the Washoe smelter and will be a direct competitor of the Garfield plant of the American Smelting & Refining Company.

MANHATTAN TRACTIONS EARNING CHARGES.—The report recently published by the Public Service Commission concerning the operation of the traction lines in Manhattan, for the quarter ended Dec. 31, 1908, shows that the surface systems, Metropolitan, Third Avenue, Second Avenue, etc., have earned while in the receivers' hands a surplus in excess of fixed charges and taxes. The last quarter of the year is not one of the best, but the receivers have operated the roads so successfully that the lines are able to pay their way. Metropolitan Street Railway earned $3,277,273 gross for the quarter, and the net earnings, after paying operating expenses, were $819,807. After paying taxes and interest on the bonded debt there was a surplus, but not sufficient to pay the high rentals upon their properties. The Third Avenue Railroad, after paying taxes, interest and rentals, had on hand $205,721.

CANADIAN WESTINGHOUSE COMPANY.—The annual report of the Canadian Westinghouse Company, Ltd., for 1908, shows net earnings of $320,377, a decrease of $106,676 from the previous year. The loss was comparatively less than that of many American manufacturing plants in similar lines and the company was able to pay its regular 6 per cent dividend on an increased capital stock and show a net surplus at the end of the year of more than $40,000. At the annual meeting the old board of directors was re-elected and subsequently the following officers were chosen: President, George Westinghouse; first vice-president, L. A. Osborne; third vice-president and general manager, Paul J. Myler; secretary, John H. Kerr.

CHICAGO & MILWAUKEE ELECTRIC FINANCING.—A special committee of Chicago & Milwaukee Electric bondholders has formulated a plan for raising $500,000 which is needed urgently to protect the property and its franchises. The plan provides for the retirement of the existing $5,000,000 of bonds by a preferred stock issue and the issue of $700,000 mortgage bonds, bearing 5 per cent, to run 20 years. Holders of 1919 and 1922 bonds would get the first preferred stock at the present market values of their holdings, 84 and 60, respectively, and the balance of the face value in second preferred stock. Common stock to the amount of $5,000,000, without voting power, but with power to retire the preferred at par and accrued dividends, would be issued for the present stock on a basis of 1 to 5 for the preferred and 1 to 3 for the common.

BROOKLYN RAPID TRANSIT EARNINGS.—The daily earnings of the Brooklyn Rapid Transit Company are reported to be increasing at the rate of from $3,000 to $5,000 over those of a year ago. Notwithstanding this the gross returns for the first eight months of the fiscal year show a falling off of almost $400,000, while the company paid $258,000 more in taxes. The operating expenses have been cut, however, to such an extent that there remains a slight improvement in net. President Winters declares that the improvement in the short-haul business of the company since the opening of the Belmont tunnel to Atlantic Avenue has more than offset the loss in through business.

KANSAS CITY, OZARKS & SOUTHERN RAILWAY.—The new electric freight and passenger line, known as the Kansas City, Ozarks & Southern Railway, that is now being constructed from Springfield, Mo., to Mansfield, Mo., on the St. Louis & San Francisco line, has been sold to St. Louis capitalists. Work was suspended on the property in January after about seven miles of roadbed had been completed. The new owners will push the construction to completion. Orders have been placed already for rails and cars. It is proposed eventually to extend the line to the lead and zinc mining districts of northern Arkansas.

RIO DE JANEIRO TRAMWAY.—The Rio de Janeiro Tramway, Light & Power Company, which is owned principally by Canadians, will ask its shareholders for authority to increase the capital stock from $25,000,000 to $40,000,000. It is intended to issue only a portion of the new stock at the present time. The immediate issue will probably amount to $6,250,000, which has already been underwritten at par. The earnings of the company for February were $434,044, an increase over the same month last year of $39,140.

FONDA, JOHNSTOWN & GLOVERSVILLE RAILROAD.—The Public Service Commission of the Second District of New York has approved the application of the Fonda, Johnstown & Gloversville Railroad Company for an increase of its capital stock from $2,500,000 to $3,000,000. The company is empowered to issue 5000 shares of preferred stock at par. One condition of the permit requires that all the property now held by the Sacandaga Park Company shall be transferred to the railroad company.

NEW BEDFORD STREET RAILWAY.—The Union Street Railway Company, of New Bedford, Mass., has petitioned the railroad commissioners for authority to issue $100,000 new bonds, and also to increase the capital stock by $225,000. The proceeds of these new issues are to be used in paying off the floating debt and for improvements. It was voted that the price at which the new shares shall be offered to the stockholders is $140 for each share of the par value of $100.

CHICAGO ELEVATED RAILWAY TRAFFIC.—The Northwestern Elevated Railway, of Chicago, made another large increase in its traffic in March, compared with the corresponding month last year, owing principally to the extension of its operating mileage. This increase amounts to nearly 13 per cent. The South Side Elevated reports a very slight increase for March, 1909, compared with the corresponding figures of a year ago.

MILLERSBURG LIGHT, HEAT & POWER COMPANY.—At a recent meeting of the Millersburg (Pa.) Light, Heat & Power Company Dr. Marion Ulrich was elected president; E. H. Leffler, secretary and treasurer, and Frank H. Kirk, general manager. During the past year the company has installed two S. Morgan Smith waterwheels of 100 hp each and has practically reconstructed its power house.

ILLINOIS CENTRAL ELECTRIFICATION PLANS.—The officials of the Illinois Central Railroad have transmitted estimates to the representatives of the city of Chicago showing that the cost of electrification of the road's suburban service would amount to $8,000,000. In the report of the officials no mention was made of E. H. Harriman's suggestion that the city pay one-half the expense.

NASSAU LIGHT & POWER COMPANY.—The Public Service Commission of the Second District of New York has authorized the Nassau (County) Light & Power Company to issue first mortgage bonds to the amount of $80,000. The bonds are to be sold for not less than 90 and the proceeds are to be used to pay the floating debt of the company and to make improvements and extensions.

MARCONI WIRELESS COMPANY'S REPORT.—The balance sheet of the Marconi Wireless Telegraph Company of America shows assets of $6,090,000, against $6,079,444 the previous year. The liabilities of the company are nominal. The lack of improvement in the company's earnings is attributed to the falling off in steamship travel during the recent period of depression.

NEW ENGLAND TELEPHONE & TELEGRAPH COMPANY.—The statement of the New England Telephone & Telegraph Company for the year 1908 shows gross earnings of $11,259,130, an increase of $579,504. The net profits were $2,560,413, an increase of $394,210. The surplus for the year was $2,360,413, an increase of $194,210.

COMMERCIAL CABLE COMPANY.—The Commercial Cable Company, the cable operating subsidiary of the Mackay companies, has issued a balance sheet dated Dec. 31, 1908. This balance sheet shows total assets of $51,431,270; the balance in cash in bank is shown to be $1,508,387, and the reserve fund to be $6,922,882.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American District Telegraph Company:					
Year 1908	3,221,727	2,435,845	785,882	398,088	387,793
Year 1907	3,017,174	2,304,214	712,960	396,889	316,061
Bell Telephone Company, of Buffalo:					
Year 1908	1,721,339	1,070,382	650,957	487,362	163,595
Year 1907	1,709,679	1,072,710	636,969	474,414	162,555
Binghamton (N. Y.) Light, Heat & Power Company:					
Year 1908	150,834	78,739	72,094	32,666	39,428
Year 1907	140,952	72,027	68,924	29,294	39,630
Canadian Westinghouse Company, Ltd.:					
Year 1908	.....	.....	320,377	249,937	40,440
Year 1907	.....	.....	427,053	215,221	111,832
Illinois Traction Company:					
February, 1909	321,847	186,030	135,817	.....	.....
February, 1908	304,538	183,368	121,170	.....	.....
Georgia Railroad Company:					
February, 1909	233,636	178,718	62,590	59,478	3,112
February, 1908	229,674	206,940	24,927	58,244	*33,317
Mexican Telephone & Telegraph Company (Mexican currency):					
Year ended Feb. 28, 1909	385,767	148,575	204,331	.....	.....
Year ended Feb. 29, 1908	388,033	153,446	209,367	.....	.....
Montreal Street Railway Company:					
February, 1909	284,090	199,912	84,178	32,037	52,141
February, 1908	270,224	201,449	68,775	32,948	35,828
New England Telephone & Telegraph Company:					
Year 1908	11,259,130	8,898,717	2,360,413	2,552,308	*191,895
Year 1907	10,679,625	8,513,422	2,166,203	1,872,817	293,386
Portland (Ore.) Railway, Light & Power Company:					
February, 1909	355,001	167,376	187,625	.....	.....
February, 1908	332,299	174,757	157,542	.....	.....

*Deficit.

GENERAL NEWS

Construction News.

MONTGOMERY, ALA.—The City Council is considering a proposition submitted by engineers representing the General Electric Company and H. R. Worthington for the installation of an electric pump with a capacity of 8,000,000 gal. and an electrically operated air lift for water in wells. It is proposed to install the electric pump independent of the present plant, to be connected with both the steam power plant and station at Tallassee of the Montgomery Light & Water Power Company. This plan is proposed instead of the installation of new boilers at the old steam plant, and it is estimated that the cost will be but little over $12,000, the estimated cost for installation of boilers.

VETO, ALA.—The Alabama holdings of the Morgan County Telephone Company were sold at Veto, March 13, to the bondholders of the company for about $131,000. The company owns long-distance lines and franchises extending from Birmingham, Ala., to Indianapolis, Ind.; also extensive system in Kentucky, Indiana, Ohio and other Northern States. The company will continue to operate its Alabama system.

WEST BLOCTON, ALA.—A company is being organized to develop a water power of from 75 to 100 hp, to be utilized to generate electricity for transmission from three to eight miles. E. D. Reynolds is interested in the project.

BEEBE, ARK.—Plans are being considered by local capitalists to install an electric light plant in Beebe.

CAMDEN, ARK.—The proposition to establish a municipal electric light plant in Camden is under consideration.

EUREKA SPRINGS, ARK.—The City Council has granted a franchise to the Greenwood & Winona Party Telephone Company to erect a telephone system in Eureka Springs.

MONTAGUE, CAL.—The Siskiyou Electric Power & Light Company is receiving copper wire at Montague, Cal., for its new 60-mile transmission line, work on which will begin immediately, and will probably be completed from Fall Creek to Session and Dunsmuir during the coming summer. The object of the company is to serve the county and to furnish electricity for lamps and motors, and especially for the installation of pumping plants. It is expected that the line will be extended to Redding and connect with the lines of the Northern California Power Company. The new power line to Dunsmuir will connect with the present line at Montague by a cross-line. J. W. Churchill is president.

NEVADA CITY, CAL.—Arrangements have been completed by the management of the Pittsburg-Cold Flat Potosi group of mines for the installation of electrical power.

OAKLAND, CAL.—The Central Oakland Light & Power Company, recently incorporated, has purchased a site for its plant on Alice Street. The company will supply electricity for lamps and motors and steam heat and power in Oakland and other cities and towns. A. M. Hunt and James Fisher, of Berkeley, and others are interested in the enterprise.

REDDING, CAL.—The incorporation of the Sacramento Valley Power Company has been made to merge the Shasta Power Company and the Northern Light & Power Company. Though competitors in the same field, the Shasta Power Company and the Northern Light & Power Company have their lines so connected as to supply each other's system with electric power in case of emergency. The Shasta Power Company has a power plant on Snow Creek, 28 miles east of Redding, and valuable water rights at the base of Mount Lassen. Its power lines cover the city of Redding. The Northern Light & Power Company's power plant is located on Old Cow Creek and also furnishes electricity in Redding.

SACRAMENTO, CAL.—The Board of Trustees has awarded the contract for furnishing and installing the pumps and apparatus for the municipal water plant to the Dowk Gas Engine Company for $5,600. The pumps can be operated by either steam or electricity.

SACRAMENTO, CAL.—Application has been made to the Board of Supervisors by the Central California Traction Company for a franchise to construct and operate an electric railway from Thirty-first and Y streets to Sacramento Avenue in Oak Park, thence to Magnolia Avenue, and to the Upper Stockton Road, and along the latter a distance of 1¼ miles to a point where the company has a private right of way to Stockton. The company proposes to build an electric railway between Sacramento and Stockton. Later the system will be extended south through the San Joaquin Valley. George W. Peltier is interested in the company.

SAN DIEGO, CAL.—The San Diego Southern Railway Company has filed amendments to its charter increasing its capital stock to $5,000,000 with provision to construct an electric railway to Los Angeles at any future time, should conditions warrant it. The company is contemplating the construction of a railway to La Jolle.

SAN JOSE, CAL.—The San José Railway Company is making arrangements to rebuild its entire street railway system from narrow to standard gage. The system includes about 15.5 miles of track. J. L. Barker is manager.

SANTA BARBARA, CAL.—The Pacific Improvement Company has petitioned the City Council for a franchise for permission to construct a transmission line to the Hope Ranch, four miles west of the city. It is said that the company contemplates installing a "trackless trolley" to the ranch.

SANTA CRUZ, CAL.—The Coast Counties Electric Light & Power Company is extending its transmission line from Watsonville to Logan, eight miles distant, where it will furnish electricity to the quarry of Granite Rock Company. The Granite company is now using steam power and has contracted with the electric company for 200 hp.

TRINITY CENTER, CAL.—The electric power plant connected with the Bonanza King Mine was recently destroyed by fire, causing a loss of about $65,000. The plant furnished electricity to operate a stamp mill and to light the mine. It is said that the mine and mill will be closed down until the plant is rebuilt.

WHEATLAND, CAL.—The Board of Trustees has awarded the contract for a 500-gal. pump and a 50-hp motor for the municipal water works system to the Abner Doble Company for $2,000.

DENVER, COL.—The Denver, Colorado Springs & Pueblo Interurban Electric Railroad Company, recently incorporated to construct an electric railway from Denver to Pueblo, a distance of 120 miles, is planning to construct the section between Denver and Colorado Springs, 75 miles in length. The power station and repair shops will be located in Denver. Arthur E. Van Dusen is secretary.

WASHINGTON, D. C.—The Washington, Spa Spring & Gretta Railroad Company has filed a mortgage to secure an issue of $500,000 in bonds to construct its proposed electric railway from Fifteenth and H streets, N. E., to Berwyn Heights and Laurel, Md., a distance of about 18 miles. James C. Rogers and others are interested.

WASHINGTON, D. C.—Bids will be received until April 13 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the various navy yards and naval stations the following supplies: New York, N. Y., Schedule 1077, electrical supplies, semaphores; Schedule 1083, steel tubing, etc.; Schedule 1095, electrical wire. Bids will also be received at the same place until April 20 as follows: Brooklyn, N. Y., Schedule 1053, seven wireless telegraph outfits, complete. Applications for proposals should designate the schedule desired by number.

DE FUNIAK SPRINGS, FLA.—The citizens will vote April 15 on the proposition to issue $10,000 in bonds, the proceeds to be used to establish an electric light system.

PANAMA SPRINGS, FLA.—The citizens are considering the question of establishing an electric light plant and water-works system.

STARKE, FLA.—The City Council has decided to make improvements to the municipal electric light and water plant, which will include the installation of the following machinery: One 100-kw generator; 150-hp boiler, engine, etc. The cost of the work is estimated at $12,000. William R. Collier, of Atlanta, Ga., is consulting engineer, and W. L. Wall, superintendent.

AUGUSTA, GA.—Contracts have been awarded for the construction of the buildings for the Manchester Cotton Mills and the Unity Cotton Mills; the first named will be equipped with 20,000 spindles and 500 looms for the manufacture of cotton cloths, at a cost of about $450,000. The new building of the Unity mill will be known as No. 2 mill and the equipment will include 10,000 spindles and will be operated by electricity. Fuller E. Callaway is president of the Manchester Cotton Mills and treasurer of the Unity Cotton Mills.

CONYERS, GA.—The State Railroad Commission has granted the Panola Light & Power Company permission to issue $25,000 in bonds and $25,000 in capital stock, making the total stock issue $50,000.

DAWSON, GA.—Telephone exchanges at Cuthbert, Fort Gaines, Edison and Shellman have recently been purchased by Dr. J. G. Dean for approximately $30,000, including long-distance lines between all of the towns named. A number of improvements will be made.

FITZGERALD, GA.—Preliminary surveys have been completed for the proposed electric railway between Fitzgerald and Ocilla, 12 miles in length. The company expects to be ready to award contracts for construction of the road by May 31. The power station will be located on Lake Beatrice between the two cities. The plant will also supply electricity for lamps. A. Holtzendorf, of Fitzgerald, is secretary and general manager. The General Engineering & Contracting Company, of New York, N. Y., has charge of the engineering work.

KOOSKIA, IDAHO.—The Kooskia Milling & Power Company is said to be contemplating the installation of a lighting plant.

CHICAGO, ILL.—The Chicago & Milwaukee Electric Railroad Company, it is reported, will soon commence work on improvements to its system, which will include the installation of additional equipment in its power station at Highland, Ill.

CHICAGO, ILL.—The Commonwealth-Edison Company has awarded contracts for the construction of two substations to the E. P. Strandberg

Company for $54,000. One of the stations will be located at Grand Crossing and the other at 9345-51 South Chicago Avenue.

STEWARD, ILL.—The Village Council has granted E. T. Beitle a franchise to construct and operate an electric light plant and water-works system in Steward. It is said that Mr. Beitle will install a plant at a cost of $10,000 with sufficient output to supply electricity for 400 lamps. Contracts for machinery and material have already been placed.

CLOVERDALE, IND.—The Town Board has decided to establish a municipal electric light plant in Cloverdale.

CROWN POINT, IND.—Arrangements are being made by the Gary & Southern Traction Company to commence work on construction of its proposed electric railway. The railway will connect Gary and Crown Point, a distance of about 12 miles. The company has not yet decided upon the location of the power house. H. W. Seaman, The Rookery, Chicago, Ill., is president.

ELKHART, IND.—The St. Joseph Valley Traction Company, which has constructed a 20-mile section of its railway, which is to connect Elkhart, Bristol, Middleburg, Shippsman and Lagrange, contemplates an extension into Elkhart this year, a distance of 15 miles; also to connect with the Toledo & Western Railroad on the east at Pioneer, a distance of 25 miles. Gasoline motor cars will be operated at first, and later the railway will be equipped to be operated by electricity. The company is capitalized at $700,000. H. E. Bucklen, 275 Michigan Avenue, Chicago, Ill., is president, and R. Jones, of Lagrange, is manager.

FORT WAYNE, IND.—Preparations are being made by the Ft. Wayne Refrigerator Company to enlarge its plant to take care of its increasing business. The improvements will include an electro-galvanizing plant and a nickel plating department.

HOBART, IND.—We are informed that the Gary, Hobart & Valparaiso Traction Company is planning to commence work on its proposed electric railway in April. The railway will be 17.5 miles in length and will connect the cities named in title. Blake A. Mapledoram is chief engineer.

KNIGHTSTOWN, IND.—The Reliance Engineering Company, of Cincinnati, Ohio, has made an investigation of the municipal electric light plant and has recommended changing some of the single-phase, 125-cycle dynamos for three-phase, 60-cycle machines.

ROSSVILLE, IND.—Arrangements are being made by the Rossville Light & Heat Company for the installation of a light and heating plant in Rossville. James E. Silverthorn is president and James R. Crouse is secretary of the company.

SOUTH BEND, IND.—Preliminary arrangements are being made by the Central Union Telephone Company for improvements and extensions to its system in South Bend, which will involve an expenditure of about $200,000.

COUNCIL BLUFFS, IA.—The Nebraska-Iowa Long Distance Telephone Company has taken over the system of the Mills County Telephone Company. The new company contemplates large extensions to its toll lines and will build an exchange at Neola.

DES MOINES, IA.—The Iowa Telephone Company, it is said, has decided to expend $1,000,000 in repairs and extensions to its system.

KEOKUK, IA.—The Keokuk Electric Railway & Power Company is said to be in the market for a 150-kw generator to supply electricity for railway service. A. D. Ayres is manager.

MARSHALLTOWN, IA.—The plant of the Petersen Heat, Light & Water Company has been ordered to be sold at a sheriff sale by Judge C. B. Bradshaw, of the United States District Court. N. M. Hawkins was appointed receiver for the company at the request of the Iowa Heating Company, of Oskaloosa. The sale is ordered to pay the cost of the receivership, aggregating $2,200.

MILTON, IA.—Plans are being made to organize a company to be capitalized at $10,000 to install an electric light plant in Milton.

MUSCATINE, IA.—The Citizens' Railway & Light Company contemplates increasing the output of its plant and expects to award contracts during the next three months for a steam turbine and generator. E. M. Walker is manager.

CLAFLIN, KAN.—Contracts have been awarded by E. R. Ruck for the construction of an electric light plant and equipment, which will include a 22-hp Weber gasoline engine and a Westinghouse direct-current generator.

EUREKA, KAN.—The local electric light plant has been purchased by G. D. Henderson and Mr. Scammehorn. The new owners will install new machinery in the plant and rebuild the transmission lines this spring. G. D. Henderson is manager.

NICKERSON, KAN.—Arrangements are being made by the Nickerson Telephone Company to construct a new telephone exchange building. A new switchboard will be installed and the entire system overhauled and rebuilt.

FRANKLINTON, LA.—The Washington Lumber Company has made application to the City Council for a franchise to install an electric light plant. George S. Lacy is manager of the company.

BETHEL, MAINE.—Work will commence on the construction of the municipal electric light plant as soon as the frost is out of the ground. Electricity for operating the plant will be secured from the Merrill-Springer spool mill.

BRUNSWICK, MAINE.—The Brunswick Electric Light & Power Company is building a new hydro-electric power station, which will be equipped with three 300-kw generators. V. Bagley is superintendent.

CALAIS, MAINE.—The International Power Company has made application to the New Brunswick Parliament for a charter. The company proposes to construct a dam on the St. Croix River half way between Baring and Woodland, where a site has been secured. The water power will be utilized to generate electricity, which will be used for commercial purposes. The company also proposes to construct an electric railway from St. Stephen to a point near Sprague's Falls on the New Brunswick side of the dam. George A. Curran and I. R. Todd are interested in the project.

PRESQUE ISLE, MAINE.—The Aroostook Valley Railroad Company contemplates building an electric railway during the coming summer from Presque Isle and Washington, with extensions later to Wade Plantation, Mapleton, Perham and Ashland.

PRESQUE ISLE, MAINE.—The Maine & New Brunswick Electrical Power Company has been granted permission by the State Legislature to extend its transmission lines to connect with the electric systems of Tracy's Mills, Centreville, Florenceville, East Florenceville, Bristol, Bath and Hartland, N. B. A. R. Gould is manager.

CAMBRIDGE, MD.—The Cambridge Gas Company and the Dorchester Electric Light & Power Company have been consolidated. The new company is capitalized at $100,000, and the following officers elected: E. C. Harrington, president; John G. Mills, secretary, and E. C. Dillon, treasurer.

BOSTON, MASS.—Bids will be received until April 26 at the U. S. Engineer Office, Boston, Mass., for furnishing boilers, engines, generators, electric cable and switchboards. Information and blank forms may be obtained on application to the U. S. Engineer Offices, at Boston, Mass.; Seattle, Wash.; Portland, Ore., and San Francisco, Cal.

NEW BEDFORD, MASS.—The Union Street Railway Company has applied to the Railroad Commissioners for permission to issue $100,000 in bonds and also to increase its capital stock by $250,000, the proceeds to be used to pay floating indebtedness and for improvements.

NEW MILFORD, MASS.—The New Milford Fire Association has authorized C. M. Beach, president, to enter into a contract with the Electric Light Company under the terms of which the company agrees to install 21 new lamps within four months.

NORTH ADAMS, MASS.—Arrangements are being made to enlarge the Blackinton Mills. A power plant to furnish electricity for lamps will be installed, to be operated by water power. An auxiliary steam plant will be provided.

OXFORD, MASS.—The Selectmen are contemplating replacing the arc lamps on Main Street with 80-cp tungsten lamps. The Webster & Southbridge Gas & Electric Company has the contract for street lighting.

SHELBURNE FALLS, MASS.—The Shelburne Falls Electric Light & Power Company has reduced the price of electricity for lamps from 20 cents to 15 cents per kw-hour.

SPRINGFIELD, MASS.—The United Electric Light Company is planning to place its wires underground along about four miles of streets in this city this year, which will involve an expenditure of about $40,000. The company will also erect a special power circuit to Brightwood.

SPRINGFIELD, MASS.—Under the terms of the new contracts made by the street lighting committee with the United Electric Light Company the city will save about $23,000 during the next five years. The price for furnishing electricity for lamps for the municipal buildings has been reduced from 9¼ cents to seven cents per kw-hour, and for motors from 4 8-10 cents to three cents per kw-hour. The rate for arc lamps served by underground conduits has been reduced from $85 to $83 per lamp per year, and for overhead circuits from $73 to $71.50 each per year, and incandescent lamps $15 per lamp per year. Under the new contract the present 40-cp incandescent lamps are to be replaced with lamps of 60 cp, the company agreeing to supply the poles. The contract calls for not less than 1000 arc lamps. The charge for incandescent lamps served by underground conduits will be $20 per lamp per year.

SUDBURY, MASS.—At the annual town meeting a committee, consisting of Waldo L. Stone, Frank F. Gerry and I. Stanley Rice, was appointed to consider the question of establishing an electric lighting system in the town.

WORCESTER, MASS.—Contracts have been awarded by the Spencer Electric Company for the construction of another building, which will be used for general manufacturing purposes. The machinery will be operated by electricity and the company, it is said, will be in the market for the necessary electric equipment later. A new tempering building and large power plant is now under construction.

GRAND RAPIDS, MICH.—The contract for transformers and switches for sewage pumping station was awarded to the Wagner Electric Company, of St. Louis, Mo., for $6,100. Samuel A. Freshney is secretary Board of Public Works.

HILLSDALE, MICH.—The Council is contemplating making improvements to the municipal electric light plant which will involve an expenditure of about $10,000.

INTERNATIONAL FALLS, MINN.—The Minnesota & Ontario Power Company has placed orders for the equipment of its large hydro-electric plant under construction at International Falls, by J. G. White & Company, of New York, N. Y. The plant at first will be equipped to generate

about 20,000 hp. Provision will be made to install another unit later. The plant will furnish power to a large paper mill and other manufacturing plants. It is expected to have the plant in operation by Jan. 1, 1910.

OWATONNA, MINN.—The Public Service Operating Company is planning to rebuild its electric light plant.

GRENADA, MISS.—The question of issuing $5,000 in bonds for improvements to the water and light plant will be submitted to a vote of the people. S. T. Tatum is mayor.

JACKSON, MISS.—The Mississippi Home Telephone Company has been granted permission by the Alabama & Vicksburg Railroad Company to construct a telephone line along the railroad company's right of way from Jackson to Meridian.

MERIDIAN, MISS.—W. F. Wilcox, manager of the municipal waterworks system, has submitted to the City Council a report showing that an electric light plant can be installed in connection with the water-works system at a cost of $75,000. The estimate is based on a plant with sufficient output to supply 500 arc lamps and sufficient incandescent lamps to light the municipal buildings. The proposed plant will not furnish electricity for commercial or residential lighting.

NEWTON, MISS.—Plans and specifications are being prepared by Xavier A. Kramer, electrical engineer, Magnolia, Miss., for a municipal electric light plant in Newton. The plant will have an output of 75 kw.

SENATOBIA, MISS.—The Board of Aldermen is contemplating the extension of the electric lighting system.

CASSVILLE, MO.—It is reported that work has commenced on equipping the Cassville & Western Railway to be operated by electricity. The railway is five miles in length and connects Cassville with Exeter, and is now operated by steam. The company, it is said, contemplates extending the railway to Carthage, Mo., and also to Eureka Springs, Ark. Water power on the White River will be developed to generate electricity for the road. The company, it is said, will erect a power house in Cassville.

KANSAS CITY, MO.—The Kansas City, Ozark & Southern Railway has been sold to St. Louis capitalists. The company is building an electric and passenger railway from Mansfield to Ava, work on which was suspended in January. The new owners propose to complete the road at an early date, and it is also proposed to extend the line to the lead and zinc mining district of North Arkansas. Orders have been placed for rails and cars.

KANSAS CITY, MO.—Arrangements are being made by the Interstate Railway & Power Company to commence construction work in May on the Iola-Chanute division and also the section between Lawrence, Kan., and Kansas City, Mo., of its proposed electric railway. The road when completed will be about 300 miles in length. The present plans call for the construction of two power plants, the main station to be located at Chanute and a smaller one at Lawrence, Kan. The company also proposes to furnish electricity for lamps and motors. This company is successor to the Southern Kansas Railway, Light & Power Company, of Chanute, Kan. R. C. Rawlins, of Kansas City, Mo., is president and general manager.

MOBERLY, MO.—It is stated that the citizens of Moberly and Huntsville have accepted the proposition made by Messrs. Manning and Wellman, of Ottuma, Ia., to build an electric street railway in Moberly, and an interurban railway between Moberly and Huntsville, at a cost of $100,000. Moberly is to give a bonus of $30,000.

ST. JOSEPH, MO.—The Interstate Railway Company and the Missouri River & Cameron Railway Company have applied to the county court for rights of way for their proposed electric railways between St. Joseph and Kansas City. The Interstate Railway will be equipped with the third-rail system, while the Missouri River & Cameron Railway is a combination electric and steam railway and will use the overhead trolley system. Joseph A. Corby is president of the Interstate Railway Company.

SPRINGFIELD, MO.—Plans are being made by the Ozark-Bell Telephone Company for extensive improvements to its system, which will consist mainly of placing its cables underground. The cost of the work is estimated at $55,000.

OMAHA, NEB.—The Western Shore Electric Railway Company has applied to the City Council for a 50-year franchise to operate a street railway over Calhoun road and the river road, and certain streets which will connect the two roads.

OMAHA, NEB.—The County Commissioners have granted the Nebraska Traction & Power Company a franchise to cross certain public roads. The company proposes to build an electric railway from Omaha to South Omaha, Ralston and Papillion, about 6.5 miles in length.

ALLENHURST, N. J.—It is understood that a bill is being prepared to be presented to the State Legislature asking for permission to sell the Allenhurst municipal electric light plant to the Atlantic Coast Electric Light Company. The borough has operated a municipal plant for some years, but it is said that enterprise has proven a failure. James M. Ralston is mayor.

BLOOMFIELD, N. J.—Arrangements are being made for the construction of a large plant for Scott & Bowne, of New York, N. Y., in Bloomfield, which will include the construction of a power plant with an output of about 200 hp.

EGG HARBOR, N. J.—The plant and holdings of the Atlantic County Electric Company in Egg Harbor have been purchased by the Enterprise Gas Company, of this place, for a consideration of $22,000.

PERTH AMBOY, N. J.—The Merchants' Progressive Association has been formed for the purpose of securing a better illumination of Seventh Street.

WILLIAMSTOWN, N. J.—The citizens are considering the question of establishing an electric light plant and water system.

AZTEC, N. M.—It is said that the irrigation project proposed by the Turley Ditch Company, recently incorporated, with a capital stock of $600,000, will require the construction of a power plant on the San Juan River, near the Colorado line.

BATAVIA, N. Y.—The project of constructing the Genesee & Orleans Railway from Batavia to North Orchard Harbor, on Lake Ontario, a distance of 30 miles, has been revived and plans are being made to commence construction work this summer. George W. Mische, of Rochester, N. Y., is interested in the project. The road will be operated by electricity transmitted from Niagara Falls.

BROADALBIN, N. Y.—The Broadalbin Electric Light & Power Company contemplates extending its transmission lines into the farming districts. J. B. Crane is manager.

BROOKLYN, N. Y.—The contract for installing electric equipment in new Public School 162 has been awarded to E. J. Duggan for $8,440. C. B. J. Snyder is superintendent school buildings.

BROOKLYN, N. Y.—Bids will be received by Bird S. Coler, president Borough of Brooklyn, Borough Hall, Brooklyn, N. Y., until April 14 for furnishing all labor and materials required for constructing motor pit, shaft tunnel and drainage structures and appurtenances, complete, for the power plant for Gowanus flushing tunnel at the head of Gowanus Canal, Borough of Brooklyn. Blank forms and further information can be secured and plans and drawings may be seen at the office of the Bureau of Sewers, 215 Montague Street, Brooklyn.

NEW YORK, N. Y.—Bids will be received until April 16 by Allen N. Spooner, Commissioner of Docks, Pier "A," foot of Battery Place, North River, New York, for furnishing all labor and materials required for installing mechanical and electrical equipment on Piers Nos. 53, 54, 56, 57, 58, 59, 60, 61 and 62, North River, between Bloomfield and Twenty-second streets, on the Chelsea section, in the Borough of Manhattan. Blank forms and further information may be obtained and plans and drawings may be seen at the above office.

CENTRAL ISLIP, N. Y.—Morris Kantrowitz, of Albany, N. Y., has been awarded the contract for the construction of the building to be erected at the Central Islip State Hospital, Central Islip, for $103,700. The contract includes the installation of two horizontal tubular boilers, engine, generator and switchboard, which will be purchased by the contractor.

GLOVERSVILLE, N. Y.—The Public Service Commission, Second District, has given its approval of an increase of capital stock by the Fonda, Johnstown & Gloversville Railroad Company from $2,500,000 to $3,500,000. The company is given permission to issue $500,000 only of stock, to consist of 5000 shares at $100 each, the proceeds to be applied to discharge its obligations.

HUNTINGTON, N. Y.—Work has commenced on the construction of the new Long Island Railroad depot, which will also be utilized as a substation. Electricity for the station will be transmitted from the power house at Long Island City.

LONG ISLAND CITY, N. Y.—The Department of Water, Gas and Electricity is changing all the 40-cp tungsten street lamps in the Borough of Queens to tungsten lamps of 60 cp, of which it is expected that 2000 will be installed before the end of the year. The arc lamps of 1200 cp, costing $90 each per year, are to be replaced with lamps of 2000 cp, to cost $100 per lamp per year. It is said that 825 additional gas and electric incandescent lamps will be distributed throughout the borough.

LYONS, N. Y.—Plans have been prepared for repair shops to be erected by the New York Central Railroad in Lyons. The plant will be equipped with an air compressor of 500 cu. ft. capacity and a complete line of woodworking and ironworking machinery. Electrical power will be used. The company has not decided whether to install a plant or to purchase the power needed.

NEW YORK, N. Y.—The Public Service Commission, First District, has granted Frederick W. Whitridge, receiver of the Third Avenue Railroad Company, permission to continue the work on the Fort George extension.

NEW YORK, N. Y.—The general contract for the construction of the large department store to be erected by Gimbel Brothers, at Greeley Square and Thirty-second Street, has been awarded to Thompson-Starrett Company, of New York, N. Y. The plans call for the installation of 41 passenger elevators and six freight elevators, which will call for considerable power equipment, hydraulic machinery, etc. D. A. Burnham & Company are the architects.

NEW YORK, N. Y.—The New York & North Shore Traction Company has obtained a franchise from the Board of Estimate and Apportionment to construct and operate a double-track street railway from the intersection of the proposed tracks on Chestnut Street, Murray Hill, Queens, to Whitestone. This will be a spur of the railway to be constructed from Little Neck to Flushing.

NIAGARA FALLS, N. Y.—Extensive additions are being made to the plant of the Development & Funding Company, of Niagara Falls, includ-

ing the erection of several buildings, power plant and transformer station. The plant will be operated by electricity generated by Niagara power.

PATCHOGUE, N. Y.—The Public Service Commission, Second District, has given the South Shore Traction Company permission to extend its railway system in the villages of Sayville and Islip.

RIVERHEAD, N. Y.—Application has been made to the Town Board for a franchise to construct and operate a street railway in Riverhead. It is proposed to build and maintain an electric railway from Riverhead depot to Orient Point. John E. Root, of New York, N. Y.; George W. Reeves, Frederick M. Lewis and J. Madison Wells, of Greenport, and George F. Stackpole, of Riverhead, are interested in the project.

ROCHESTER, N. Y.—H. B. Graves, 74 State Street, Rochester, N. Y., is contemplating the installation of a 75-hp gas-producer plant and two gas-engine-driven generators to furnish electricity for lamps and elevators, and is ready for estimates on the above equipment.

ROSLYN, N. Y.—The Public Service Commission, Second District, has authorized the Nassau Light & Power Company to issue its first mortgage bonds to the amount of par value of $80,000, the bonds not to be sold at less than 90 per cent of their par value, the proceeds to be used to take up outstanding obligations, for the acquisition of property and construction, completion, extension and improvements to its plant and distributing system.

SENECA FALLS, N. Y.—The Geneva-Seneca Electric Company is contemplating the installation of a new street lighting system in Seneca Falls.

WATERTOWN, N. Y.—The City Council has authorized E. W. Sayles, city engineer, to prepare plans and specifications for the construction of a municipal electric light plant for the city.

GREENVILLE, N. C.—Bids will be received by Thomas J. Jarvis, chairman executive committee, until May 4, for the construction of power house and infirmary at East Carolina Teachers' Training School, also for machinery, including boilers, stack, engine, laundry machinery, ice plant generator, etc. Further information and specifications can be secured from Hook & Rogers, of Charlotte, N. C., and H. W. Simpson, Newbern, N. C., architects.

HENDERSONVILLE, N. C.—The Appalachian Power Company, recently incorporated, contemplates the construction of a power plant on Green River at Potts Shoals, seven miles from Hendersonville. The company will furnish electricity for lamps and to manufacturing concerns.

ROCKY MOUNT, N. C.—F. C. Topleman, manager of the Home Telephone Company, is making preparations for installing an improved service to Spring Hope, after which it is contemplated that other interurban extensions will be rebuilt and improved.

WINSTON-SALEM, N. C.—The P. H. Hanes Knitting Company is installing new machinery in its No. 2 mill, which will be operated by electricity.

CLEVELAND, OHIO.—H. Schmidt has applied to the City Council for a franchise to construct and operate a double-track street railway upon certain streets in the city.

CLEVELAND, OHIO.—The Cleveland Worsted Mills Company is making preparations to construct an addition to its power plant, work on which will begin soon. The company is in the market for a 1500-kw, alternating-current generator direct connected to a Corliss engine. George S. Rider & Company, Century Building, Cleveland, Ohio, are the engineers.

COLUMBUS, OHIO.—It is reported that arrangements are being made by the Columbus, Delaware & Marion Railway Company to close the gap between the northern terminus of the Columbus, Delaware & Marion Railway and one of the railways out of Toledo. John G. Webb is president.

HAMILTON, OHIO.—Plans are being made to extend the transmission lines of the municipal electric light plant to Warwickshire.

LIMA, OHIO.—The Western Ohio Railway Company is considering the purchase of an 800-kw generator. F. D. Carpenter is general manager.

SPRINGFIELD, OHIO.—George W. Baker, president of the Springfield & Washington Railway Company, has submitted a proposition to the merchants and business men of this city and the residents of Clifton, Cedarville and Jamestown, offering to build an electric railway connecting the above places if stock to the amount of $50,000 is subscribed.

OKEMAH, OKLA.—The citizens recently voted to issue $55,000 in bonds for the construction of a water-works system and electric light plant, of which $5,500 will be utilized for the electric plant. O. J. Dossey is chairman of town trustees.

OKLAHOMA CITY, OKLA.—Homer W. Hurst, of Holdenville, is reported to have made application to the City Council for a franchise to construct and operate an electric railway in Oklahoma City.

PORTLAND, ORE.—The City Council has passed the blanket franchise asked for by the Portland Railway, Light & Power Company for its proposed extensions.

PORTLAND, ORE.—Arrangements are being made for the construction of an electric railway between Kenton and the new Swift packing plant on Columbia slough, a distance of 2¼ miles. Bids have been asked for track laying and overhead wiring. Electricity for operating the road will be secured from the plant of the Monarch Lumber Company, on the peninsula. A company has been incorporated, with a capital stock of $40,000, by C. C. Colt, J. C. Good, George S. Heusner and C. H. Carey.

PORTLAND, ORE.—A syndicate composed of Samuel Hill, Hervey Lindley, E. A. Stuart, W. G. Collins and M. A. Arnold, of Seattle, Wash.; William M. Ladd, P. L. Willis, W. F. Burrell, F. H. Page and I. N. Fleischner, of Portland, Ore., has purchased the entire stock holdings of the National Securities Company, of Los Angeles, Cal., in the Home Telephone Company, of Portland, the Home Telephone Company of Puget Sound and the Northwestern Long Distance Telephone Company, of Portland. Plans are now being prepared for extensive improvements to the Portland plant, which will involve an expenditure of $200,000, and $500,000 later. A large amount will also be spent on the plant of the Home Telephone Company of Puget Sound in the near future. The new company has been incorporated under the name of the Home Telephone Company. Harvey Lindley is president and general manager.

ROSEBURG, ORE.—Kendall Brothers, owners of the local water and electric light systems, have applied to the City Council for a franchise to construct a street railway system in Roseburg.

BEAVER, PA.—Owing to a disagreement between the College Hill Council and the Beaver Valley Electric Light Company, the street lighting service has been discontinued for the past week. The Burgess vetoed the contract and the Council failed to pass it over his veto. As yet nothing has been done on the electric light plant for which bonds to the amount of $15,000 were recently authorized. It is said that the contract has been awarded to the Westinghouse Electric & Manufacturing Company.

CARLISLE, PA.—The Town Council has granted a franchise to the Cumberland Railway Company to construct and operate its railway over certain streets in the town. The railway will be about 15 miles in length.

GROVE CITY, PA.—Application has been made to the City Council by the Slippery Rock & Grove City Railway Company for a franchise to construct an electric railway in the city. The company proposes to build an electric railway from Slippery Rock, via Harrisville to Grove City.

MEADVILLE, PA.—The Meadville & Conneaut Lake Traction Company is contemplating the purchase of mechanical stokers. F. R. Shryock is general manager.

NORTHEAST, PA.—Plans have been completed by Ballinger & Perrot, engineers, for a large plant for the Grape Products Company, in Northeast, for the manufacture of unfermented grape juice and allied products. Two electric elevators will be installed, for which bids will be received by the engineers. The power plant will include two boilers, engines and generators, which will be purchased by the company direct.

WOONSOCKET, R. I.—The new mill of the Woonsocket Machine & Press Company will be operated by electricity, which will be furnished by the Woonsocket Electric & Machine Company. Three motors with a total rating of 110 hp are being installed. The old plant of the company is operated by a steam engine and gas engine. It is said that the electric motors are to replace the gas engine.

CENTERVILLE, S. D.—A proposition to construct an interurban railway from Sioux City to Centerville is under consideration by the farmers of Union and Clay Counties. Fred Heglin and John Norin, of Dalesburg, and A. S. Anderson, of Alsen, have been appointed to investigate the matter.

AUSTIN, TEX.—The water and light committee is reported to have decided to adopt the plans prepared for rebuilding of the dam. The cost of the dam, machinery and equipment is estimated at $750,000. The new site is located about 2000 yds. above the present dam at Mount Bonnell.

CALVERT, TEX.—The City Council has awarded the Calvert Electric Light Company a new contract for street lighting. It is said that the company will erect a new electric light plant.

CORPUS CHRISTI, TEX.—The City Council is considering two applications for a street railway franchise, one from Arnim & Arnim, of Lavaca County, and the other from J. W. Arnold, of San Angelo, Tex.

PARIS, TEX.—The City Council is considering the question of establishing a municipal electric light and power plant.

SAN ANTONIO, TEX.—We are informed that the San Antonio Traction Company expects to place contracts for the construction of a four-mile extension to Palm Gardens during the next two weeks.

SAN MARCOS, TEX.—The Texas Irrigated Farm Company has made application for a franchise to construct and operate an electric light plant in San Marcos.

WACO, TEX.—The City Council has granted the Citizens' Railway Company a franchise to extend its railway across the Brazos River, on the suspension bridge, into East Waco.

WHARTON, TEX.—The City Council has granted a 50-year franchise to J. J. Wensley, to construct and operate an electric plant in Wharton.

COLD SPRINGS, UTAH.—We are informed that the Snowflake Gold Mining & Power Company expects to commence work on the construction of its power plant in about 60 days. The company proposes to supply electricity for power to the mining camps in this vicinity. C. A. Short is president and manager.

PROVO, UTAH.—The Telluride Power & Transmission Company contemplates making improvements to its service and will within the next few months erect a duplicate transmission line from Logan to Provo and from Logan to Grace, Idaho. The company is planning to replace wooden poles with steel towers. Work on the section between Logan and Salt Lake City will begin within two weeks.

BARTON HEIGHTS (P. O. RICHMOND), VA.—The Citizens' Association has decided to issue $50,000 in bonds, the proceeds to be used

for construction of an electric light plant and water-works system. The proposition will be submitted to the vote of the people.

BEDFORD CITY, VA.—Plans are being considered for the construction of an electric railway from Bedford City to connect with the Virgian Railway. It is proposed to secure electricity for operating the railway from the Roanoke Street Railway & Electric Company. B. E. Rice, industrial agent of the Virgian Railway; Robert N. Gaines, of Bedford City, and H. C. Webb, of Stewartsville, are interested in the project.

BUENA VISTA, VA.—Contracts have been awarded by the Rockbridge Power Company to the General Electric Company, of Schenectady, N. Y., for the entire equipment of its new power plant at the Goose Neck dam, four miles below Buena Vista.

CLINTWOOD, VA.—It is reported that the business men in Clintwood are planning to organize a company to construct an electric railway from Clintwood to the nearest point on the Carolina, Clinchfield & Ohio Railway, which is being constructed through Dickenson County down the McClure River. The railway will be about six miles in length. Roland E. Chase, A. A. Skeen and Columbus Phipps, all of Clintwood, are interested in the project.

FREDERICKSBURG, VA.—We are informed that the City Council has granted a 30-year franchise to the Fredericksburg Electric Company to furnish electricity for lamps, heating and motors in Fredericksburg. The Council also granted a franchise to the Electric Generating Company (an ally of the Fredericksburg Electric Company) to construct a flume and power house within the city limits. The Fredericksburg Electric Company contemplates an expenditure of about $25,000, and the Electric Generating Company will expend about $100,000. Work on construction of these plants will begin about the middle of this month. William C. Whitner is consulting engineer.

HIGHLAND PARK (P. O. RICHMOND), VA.—The proposition to issue $50,000 in bonds, the proceeds to be used for electric lighting, water supply and sewerage, will be submitted to the vote of the people.

CHEHALIS, WASH.—The Valley Development Company is making arrangements to proceed with its power development at Packwood Lake, in the Cascade Mountains. The plans call for the erection of a large dam at the outlet of Packwood Lake, about eight miles distant from Sulphur Springs, and fluming the water a distance of six or seven miles, near the farm of August Snyder, where a large power plant will be erected. It is understood that the company proposes to transmit electricity to Southwestern Washington, to the Sound cities and to Portland.

CONCONCULLY, WASH.—Arrangements are being made for the Conconcully Copper Mining Company for the installation of an electric light and power plant to furnish electricity for lamps and motors for the mines and also for the town of Conconcully. R. H. Hargrove is president of the company.

EVERETT, WASH.—The Everett Railway, Light & Water Company has awarded a contract to the Stone & Webster Engineering Corporation for the construction of a substation, the equipment of which will include one 500-kw motor generator, with switchboard and transformers.

NORTH YAKIMA, WASH.—The Central Washington Investment & Power Company, recently organized by George S. Rankin and others, contemplates furnishing electricity for lamps and motors through the entire valley, including the section now under irrigation.

OLGA, WASH.—It is reported that Robert Moran, of Rosario, Wash., contemplates the construction of an electric light and power plant and water-works system in Olga, for which a franchise has been secured.

SPOKANE, WASH.—The Spokane-Orient Power Company, recently incorporated, proposes to develop the water power of Boulder Creek, near Orient, where a fall of about 300 ft. can be secured capable of developing 2500 hp. The company will supply electricity in Orient and other towns in that vicinity. C. H. Patten and C. A. Lunchford, both of Spokane, are interested in the project.

WASHOUGAL, WASH.—It is reported that a dam will be erected about two and one-half miles from Washougal, where 1000 hp will be developed for an electric light and power plant. The transmission line is now being erected. Cottrell & Son have a franchise for an electric system in Washougal.

WINLOCH, WASH.—The business men of Winloch have organized a local telephone company, with the following officers: J. A. Venness, president; C. Rountree, vice-president; R. Whistler, secretary; J. V. Warren, treasurer, and C. E. Leonard, manager.

YACOLT, WASH.—J. M. Coulter, who was recently granted a franchise by the Town Council, contemplates the construction of an electric light plant at a cost of about $10,000.

BELOIT, WIS.—The Beloit Water, Gas & Electric Company contemplates making extensions to its system for the purpose of furnishing electrical service to manufacturing plants, particularly to the metal working industries.

JANESVILLE, WIS.—The Janesville Machine Company is preparing to enlarge its implement factory, which will be equipped with elevators, air hoists and a complete trolley connection. The company will also increase the equipment of its power plant, which will include the installation of a 100-kw, 250-volt, direct-connected generator.

KNOWLES, WIS.—It is reported that Sterr Brothers contemplate the construction of an electric light and power plant in Knowles.

NEENAH, WIS.—The citizens are considering the question of establishing a municipal electric light plant. A committee has been appointed to investigate the matter.

NEW RICHMOND, WIS.—The Willow River Lumber Company contemplates increasing the output of its power plant.

WAUWATOSA, WIS.—The Milwaukee Light, Heat & Traction Company, of Milwaukee, has been granted a franchise by the Town Board to construct and operate an electric railway in Wauwatosa.

GRAND FALLS, N. B., CAN.—Additional equipment consisting of air compressors, electric motors, drills, tunneling machines, pumping, hoisting engine, derricks, concrete mixer, rock crushers, gasoline towboat, scows, machine and blacksmith shop tools, etc., will soon be purchased by Frank B. Gilbreth, of New York, N. Y., to be used in connection with the construction of the hydro-electric plant on the St. John River, at Grand Falls, N. B., for the Grand Falls Power Company. This equipment is for the contractor's plant, the hydro-electric machinery for the permanent equipment of the main power plant will not be purchased by Mr. Gilbreth, who has the contract only for the construction work involved in the development of the water power. John B. McRae, of Ottawa, Ont., is chief engineer, and Ralph Mershon, of New York, N. Y., electrical engineer.

STELLARTON, N. S., CAN.—The Edgarton Tramway Company, Ltd., is reported to have purchased the power plant of the New Glasgow Electric Company and proposes to move the plant from New Glasgow to Stellarton.

CHIPPAWA, ONT., CAN.—The Village Council has granted the Welland County Telephone Company a franchise to extend its telephone lines to this village.

LONDON, ONT., CAN.—The London Street Railway Company is considering the question of providing additional power for its system during the coming summer, but as yet has not decided upon the electrical equipment to be installed. C. B. King is manager.

MIDLAND, ONT., CAN.—The Simcoe Electric Railway & Power Company, it is said, will commence work on the construction of its proposed electric railway to connect Penetanguishene, Midland, Virginia Harbor, Waubaushene and Coldwater. The company is planning to build a power plant on the Swern River at Big Chutes, and also proposes to furnish electricity for lamps and motors. James Playfair and Douglas L. White, of Midland, are among the directors.

PETERBOROUGH, ONT., CAN.—At an election held recently the citizens defeated the proposition to issue $15,000 in bonds to construct a municipal power plant in connection with the new water-works dam.

New Industrial Companies.

THE SOUTHERN ENGINEERING COMPANY, of Dallas, Tex., has been incorporated, with a capital stock of $5,000, by Robert L. Shaffer, Henry M. Raynolds and John F. Bruhns.

WINFREY, SCHLAFLI & PORTER, of Houston, Tex., have been incorporated for the purpose of carrying on a civil, mechanical and industrial engineering and contracting business. H. P. Porter is general manager.

THE RELIANCE ELECTRIC COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $10,000, to do a general electrical construction business by Edward A. Cassin, Theodore C. Gordon and E. M. Schultz.

THE CERO COMPANY, of Rutherford, N. J., has been incorporated, with a capital stock of $100,000, to do a general mechanical engineering business, by W. P. Smith, A. P. Coon and P. T. Davis, of Rutherford, N. J.

THE CHICAGO STEAM SPECIALTIES COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $100,000, by E. D. Packard, A. Jackson and F. P. Leffingwell. The company proposes to manufacture machinery, etc.

THE ARKICYDE COMPANY, of Colonie, N. Y., has been incorporated, with a capital stock of $50,000, by William S. Milliken, of Troy; James H. Nerns and Frank W. Spreter, of Cohoes, N. Y. The company proposes to do a general electrical business.

THE AMERICAN THERMOSTAT COMPANY, of Elmira, N. Y., has been chartered, with a capital stock of $25,000, by Burchard C. Johnson, Arthur McClellan and Byron R. Johnson. The company proposes to manufacture thermostats and electrical devices.

THE AMERICAN PRODUCER GAS ENGINE COMPANY, of Hoboken, N. J., has been chartered by F. H. Loomis, G. A. Rifflard and D. E. Griswold, all of New York, N. Y. The company is capitalized at $100,000 and proposes to do a geenral mechanical engineering business.

THE FRANKLIN SUPPLY COMPANY, of New York, N. Y., has been chartered, with a capital stock of $5,000, by Benjamin Fox, Isidor Cohen, of New York, N. Y., and Max Kafsky, of Brooklyn, N. Y. The company proposes to deal in gas and electric fixtures and gas and electric supplies.

THE COMBINATION ENGINE POWER COMPANY, of Boston, Mass., has been chartered, with a capital stock of $100,000, for the purpose of manufacturing and selling engines and machinery. The officers are: J. L. Arnold, of Manchester, president, and G. B. Clark, of Boston, treasurer.

THE YOUNG-GRAY COMPANY, of Toledo, Ohio, has been incorporated by E. R. Young, J. B. Mueller, T. N. Young, V. I. Gray and J. W. Lyons. The company is capitalized at $25,000 and proposes to install steam, electrical and hydraulic, air, refrigerator, heating and drying machinery.

THE INTERNATIONAL MARINE INDICATOR COMPANY, of New York, N. Y., has been chartered, with a capital stock of $500,000, to manufacture engines, machinery and mechanical and electrical appliances. The incorporators are: E. E. Dickey, E. J. Miller and S. Jarus, of New York, N. Y.

THE ELECTRIC DEVELOPMENT COMPANY, of East Orange, N. J., has filed articles of incorporation, with a capital stock of $1,000,000. The incorporators are: L. S. Holmes and W. Huck, Jr., of East Orange, N. J. The company proposes to do a general electrical and mechanical engineering business.

THE MOTOR LEAGUE OF AMERICA, of Syracuse, N. Y., has filed articles of incorporation, with a capital stock of $100,000, for the purpose of manufacturing motors, engines, cars and vehicles. The incorporators are: Alexis A. Schlachter, Ernest Woods and T. Aaron Levy, of Syracuse, N. Y.

AMERICAN REGENERATOR COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $150,000, to manufacture steam regenerators or accumulators and appliances, tools, etc. The incorporators are: C. A. Wendell, L. E. Varney, of New York, N. Y., and S. C. Munoz, of Montclair, N. J.

THE ADVERTISCOPE LAMP COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $50,000, to manufacture lamps for illuminating and advertising purposes. The incorporators are: Max Scott, Isidor I. Zeeman, Benjamin Hodes and M. Solomon, all of New York, N. Y., and H. E. Lazarus, of Chicago, Ill.

New Incorporations.

EUREKA SPRINGS, ARK.—The Greenwood & Winano Party Telephone Company has been organized for the purpose of erecting a rural telephone line on the south of the city to connect with the Eureka Springs telephone system. James Hull is president, and George Russ, treasurer and business manager.

EUREKA SPRINGS, ARK.—The Ozark Traction Company has been incorporated, with a capital stock of $50,000, for the purpose of constructing an electric railway from Eureka Springs to connect with towns in north Arkansas. The officers: S. M. Mitchell, president; W. T. Ayers, vice-president; B. J. Rosewater, secretary, and O. H. Orendorf, treasurer.

FRESNO, CAL.—Articles of incorporation have been filed by the Sierra Park Electric Company, of Fresno, for the purpose of developing the water power of the San Joaquin River to be utilized to generate electricity. The company is capitalized at $100,000. The incorporators are: C. K. Kirby, of Fowler; John W. McLaughlin, of Fresno; C. K. Kirby, Jr., of Fresno; F. K. Kirby, of Fowler, and D. C. McLaughlin, of Fresno.

MODESTO, CAL.—The Modesto Interurban Railway Company has been chartered, with a capital stock of $200,000, by T. K. Beard, G. P. Shafer, H. T. Crow, W. H. Frazine, George Perley, D. E. Saunders and L. L. Dennett, all of Modesto. The company proposes to construct an interurban railway from Modesto, Empire, Waterford and Oakdale, also from Modesto to Newman and Crows Landing. The railway will be about 53 miles long. It is said that the company contemplates operating gasoline electric cars.

TULARE, CAL.—The Tulare Home Telephone Company has been chartered, with a capital stock of $25,000. The directors are: G. C. Harris, B. W. Chenoweth, Scott Hendricks and Thomas J. Franklin, of San Francisco, and Edward W. Rice, of Berkeley, Cal.

ATHENS, GA.—The New Timothy Telephone Company has been organized to construct a telephone line from New Timothy to Athens, via Winder. The officers of the company are: W. J. Russell, president; P. L. Duncan, secretary and treasurer, and H. P. Hardigree, general manager.

HULL, GA.—The Free State Telephone Company has been incorporated, with a capital stock of $500, by J. C. Coile, W. F. Matthews, B. B. Chandler, G. H. Rice, and others. The company proposes to construct a telephone line from Hull via Neese to Danielsville.

BRYON, ILL.—The Tri-City, Northeastern & Interurban Railway Company has been organized for the purpose of constructing an electric railway from Watertown, Rapids City, Port Byron, Cordova and Albany. The company is capitalized at $10,000. The officers are: J. W. Simonson, of Port Byron, president; W. H. Ashdown, of Port Byron, vice-president; George W. Turner, of Hampton, secretary; C. H. Peck, of Albany, treasurer, and Wallace Treckler, chief engineer.

CHICAGO, ILL.—The Telepost Company, of Illinois, has been incorporated, with a capital stock of $10,000, to construct and operate telephone and telegraph lines, by C. C. Robertson, W. R. Watson and W. R. Holton.

ELGIN, ILL.—The Elgin & Sycamore Railway Company has been chartered with a capital stock of $100,000 to construct an electric railway from Elgin to Dixon and to Aurora. The incorporators are: B. C. Bailey, E. S. Bailey, F. J. Hohing, F. W. Merrick and F. N. Rogers, all of Elgin.

ELGIN, ILL.—Articles of incorporation have been filed for the Elgin & Evanston Railway Company by C. A. Sayer, J. A. Hessler, A. W. Hellis, E. F. Reynolds and G. H. Norton, all of Berwyn, Ill. The company is capitalized at $2,500 to construct an electric railway from Elgin through Desplaines to Evanston.

PERU, ILL.—The Cedar Point Telephone Company has been incorporated, with a capital stock of $1,100, by Elmore H. Whitaker, Robert H. Johnston, and John Martens.

LOGANSPORT, IND.—The Logansport, Bass Lake & Laporte Electric Company has been incorporated to build an electric railway 60 miles in length, to cost about $900,000. The incorporators are: James C. Fletcher, John W. Long, Peter Henderweele, Henry C. Schrecker and C. H. Peters.

SOUTH BEND, IND.—The Manufacturers' Utility Company has been incorporated to acquire sites, build and maintain water-power plants to generate electricity; also to construct buildings and lease the same to manufacturers and other persons. R. M. Miller, August Nelson and John Thomas are directors.

CLEGHORN, IOWA.—The Cleghorn Independent Telephone Company has been incorporated, with a capital stock of $1,000.

EDGEWOOD, IOWA.—The Edgewood Farmers' Telephone Company has been chartered, with a capital stock of $5,000.

THOMPSON, IOWA.—The Thompson Telephone Company has been organized by a number of local business men. The company has purchased the local telephone exchange from W. A. Eckels, of Nora Springs.

CLYDE, MINN.—The Farmers' Mutual Telephone Company has been incorporated, with a capital stock of $10,000.

ERIE, MINN.—The Red Lake-Eastern Marshall Farmers' Telephone Company has been incorporated, with a capital stock of $10,000, by Alex F. Lattimore, of Erie, and others.

MINNEAPOLIS, MINN.—The Christmas Lake Telephone Company has been organized, to erect a telephone line between Christmas Lake and Lake Minnetonka.

FLORENCE, NEB.—The Western Shore Electric Railway Company has been incorporated by L. M. Allen, L. C. Nebergall, D. C. Gould, J. F. Munro and J. T. McVittie. The company is capitalized at $150,000 and proposes to construct an electric railway from Florence to Blair.

KEARNEY, NEB.—The Union Valley Telephone Company has been incorporated, with a capital stock of $5,000, by Patrick Fitzgerald, George Bischel, N. B. Freeman, H. G. Reiter, and others. The company proposes to construct telephone lines through Center and Thornton Townships.

STAMFORD, NEB.—The Highland Mutual Telephone Company has been incorporated, with a capital stock of $10,000, by I. K. Asford, Charles Hopper, and others.

KNOWLES, N. M.—The Knowles-Monument Telephone Company has been chartered, with a capital stock of $1,000, by J. L. Emerson, W. U. Dannelley and H. F. Christian, all of Carlsbad.

SELMA, N. C.—The Selma Telephone Company has been incorporated with a capital of $5,000 by T. H. Atkinson, of Washington, D. C.; L. H. Allred, of Selma, and others. The company has a franchise to build rural telephones in the Selma district.

BROFY, N. D.—The Emmons County Telephone Company has been incorporated, with a capital stock of $4,000, and the following named officers: C. A. Ward, president, and William Foell, secretary.

HOMESTEAD, N. D.—The Wyndmere & Homestead Farmers' Telephone Company has been formed, with N. C. Jensen, president, and G. O. Sandem, secretary.

CARNEGIE, OKLA.—Articles of incorporation have been filed for the Carnegie Power & Improvement Company, with a capital stock of $100,000. The company proposes to construct a dam and power house. The equipment will include four 250-hp gas engines, direct-connected to generators. The company will furnish electricity for lamps and motors in Carnegie, Hobart, Gotebo, Mountain View, Apache and Lawton. The officers are: John V. Roop, of Hobart, president; W. T. Croslen, of Chichasha, Okla., vice-president and general manager; J. T. McCormick, of Little Rock, Ark., secretary and treasurer.

HINTON, OKLA.—The East Niles Telephone Company has been incorporated with a capital stock of $1,500 by William Woods, H. B. Tillinghast and J. C. Ridge, all of Niles.

DAMASCUS (P. O. CLACKAMAS), ORE.—The Damascus Mutual Telephone Company has been incorporated, with a capital stock of $5,000, by A. W. Cilk and others.

LAWRENCEVILLE, PA.—The Browntown Telephone Company has filed articles of incorporation, with a capital stock of $1,000, for the purpose of constructing a telephone line to connect Lawrenceville with Browntown and other points in Steuben County. The incorporators are: Fred A. Burr, Ezra Maxwell, Charles Phelps, Leon Terwilliger, and others.

MERCER, PA.—The Osgood Telephone Company has been organized for the purpose of constructing telephone lines in the northern and eastern parts of Mercer County. The officers of the company are: Henry Green, president; Thomas Barrows, secretary.

Trade Publications.

PUMPS.—Catalogue No. 72, of the Dean Bros. Steam Pump Works, Indianapolis, Ind., deals with hydraulic pressure pumps. These pumps are of the reciprocating type, driven either by steam engine or electric motors.

ELECTRIC CLOCKS.—S. S. Besore, Urbana, Ill., has issued an illustrated, descriptive bulletin, dealing with self-winding clocks. These clocks are wound by means of self-contained electro-magnets, receiving energy from dry cells.

CARBON BRUSHES.—The Morgan Crucible Company, Ltd., Battersea Works, London, Eng., has issued a well-prepared catalogue, giving much specific information concerning Morganite and Battersea carbon brushes for electrical machinery.

MOTORS.—The Westinghouse Electric & Manufacturing Company has issued a series of "Talks" on motors. No. 4 is devoted to a discussion of the relation of the electric motor to central-station business. No. 6 deals with textile-mill motors.

WIRING SPECIALTIES.—The Fancleve Specialty Company, Jamaica Plain Station, Boston, Mass., has issued a catalogue devoted to conduits, switch-boxes, junction-boxes, mouldings and moulding-boxes. The fittings described are illustrated in detail, and fully listed.

MILL-SERVICE INDUCTION MOTORS.—Polyphase induction motors of the constant-speed, squirrel-cage type, designed especially for steel-mill service, are well illustrated and completely described in Circular No. 1164 of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

STEAM HAMMERS for all industrial purposes are discussed in a neatly executed catalogue issued by the Niles-Bement-Pond Company, New York. Specifications are given of single-frame hammers rated at from 250 to 4000 lb., and of double-frame hammers rated at from 1500 to 3000 lb.

CENTRIFUGAL BLOWERS.—The American Blower Company, Detroit, Mich., has issued an artistic catalogue, discussing the advantageous features of Sirocco centrifugal fans. Tabulations are given of fans ranging in diameter from 6 in. to 90 in. They are well adapted for direct connection to electric motors.

ELECTRICALLY DRIVEN WASHING MACHINE.—With the title of "A Penny Pays for the Washing," the Thompson Bros. Company, of Grinnell, Ia., has issued a handsome little pamphlet descriptive of a type of washing machine especially adapted to be driven by an electric motor. Some of the illustrations are in colors.

GAS AND GASOLINE ENGINES.—The Otto Gas Engine Works, Philadelphia, Pa., have issued neatly executed catalogues, illustrating and describing gas and gasoline engines. These engines are particularly well suited for driving electric generators. Engines intended for this duty are treated as standard for ratings of from 3.5-hp to 160-hp.

TRANSFORMERS.—The Pittsburgh Transformer Company, Pittsburgh, Pa., is distributing illustrated descriptions of its transformers. Plate No. 1023 shows a 1000-kw oil-insulated water-cooled unit; Plate No. 1026 illustrates a 300-kw oil-insulated self-cooled unit, while Plate No. 1049 deals with a 200-kw self-cooled oil-insulated circular-pattern transformer.

INSTRUMENTS.—Electrical instruments of precision are thoroughly discussed, illustrated and listed in Bulletin No. 84, of the Wagner Electric Manufacturing Company, St. Louis, Mo. The instruments are of both the direct-current and the alternating-current types, and include voltmeters, ammeters and wattmeters for both portable and switchboard use.

Personal.

MR. CHAS. E. WADDELL will deliver a course of lectures before the Biltmore Forest School, Biltmore, N. C., on the subject of the application of the electric drive to woodworking machinery.

MR. E. H. STEVENS has resigned as superintendent of plants of the Public Service Corporation of New Jersey to become vice-president and general manager of the Bird-Archer Company, New York.

MR. SAMUEL INSULL, president of the Commonwealth Edison Company, Chicago, is spending the Easter holidays in London, his old home. Mr. Insull sailed from New York on March 30 and expects to be back in his Chicago office in about four weeks from that time.

MR. BRUCE FORD, in charge of the department of development and design of the Electric Storage Battery Company, Philadelphia, is making a satisfactory recovery after an operation for appendicitis at a Germantown hospital.

MR. W. G. T. VIBBER has purchased the interest of Mr. W. H. Emery in the Marlborough Electric Company, of which he becomes president. Mr. Edward C. Mason has been elected treasurer, and Mr. C. S. Davis general manager of the company.

MR. W. I. CAPEN, general superintendent for the Postal Telegraph Company in Chicago, has been promoted to a higher position in the New York office. Mr. T. W. Carroll, who has been assistant general superintendent, has been appointed to fill the position formerly occupied by Mr. Capen, and Mr. F. W. Conger, superintendent, has been given the office made vacant by Mr. Carroll's promotion.

MR. J. H. BRUNINGA has resigned from the U. S. Patent Office, in which he has been an examiner the past three years, to engage in the practice of patent law, with offices in McGill Building, Washington. Mr. Bruninga is a graduate of Bradley Polytechnic Institute and the Law School of the George Washington University, and prior to entering the Patent Office was an assistant in the laboratory of the Bureau of Standards. He will make a specialty of electrical and mechanical cases.

MR. T. J. McGILL, formerly manager of the Minneapolis office of the Westinghouse Electric & Manufacturing Company, has been transferred to Atlanta and placed in charge of the district office in that city. The Minneapolis office has been placed under the jurisdiction of the Chicago district office in charge of Mr. T. P. Gaylord. Mr. W. D. McDonald, of the Chicago office, goes to Minneapolis to succeed Mr. McGill. The Milwaukee and Omaha offices were already sub-offices under the Chicago district office, and now Minneapolis makes a third.

MR. H. C. SLEMIN has been appointed to the dual position of sales and advertising manager of the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y. Mr. Slemin had occupied the position of advertising manager of the same company since February, 1907, after three years of service with that company in various other lines of work, including charge of its cable business. Mr. Slemin after leaving the manual training school in Chicago went with the Western Electric Company in 1896, and after going through several departments in the works, and spending considerable time in the drafting room, he entered the apparatus engineering department. Three years later he entered the engineering sales department, and after spending a year and a half there entered the employ of the Stromberg-Carlson Telephone Manufacturing Company in 1904 to take charge of its apparatus engineering department.

MR. H. C. SLEMIN.

Obituary.

MR. CHARLES G. CONNER, of the Sprague Electric Company, died March 27, following a surgical operation. He became ill in his office on Feb. 17, and was immediately taken to his home and from there to the hospital. On the 19th he was operated upon because of an intestinal abscess. Blood poisoning set in, and for a little more than a week he made a hard struggle for life. The funeral was held at his late residence, 524 Righter Street, Philadelphia, on March 30 at 1 p. m. The interment was in Indianapolis. Mr. Conner was manager of the Philadelphia office of the Sprague Electric Company from Feb. 16, 1903, until his demise. He made a large circle of friends by his cordiality, straight business dealings and thorough knowledge of the electrical business. Mr. Conner leaves a widow and a son three years old, to whom sincere sympathy is extended.

Business Notes.

THE STANDARD ELECTRIC ACCUMULATOR COMPANY, of New Jersey, has removed its offices from 141 Broadway to 91-93 Mercer Street, New York.

HARVEY HUBBELL, INC., of Bridgeport, Conn., has awarded a contract for the construction of a new factory building, which will be located on State Street, between Bostwick Avenue and Mt. Grove Street.

PETTINGELL-ANDREWS TRADE-MARK.—The Pettingell-Andrews Company, Boston, has adopted as a trade-mark a design based on the word "Exemplar." This trade-mark will be used on all literature of the firm and also on lines of electrical goods of special quality.

THE MUNDER ELECTRIC COMPANY is moving its factory from Springfield, Mass., to Central Falls, R. I., where it has another large manufacturing plant. The company will retain its sales office and carry a complete stock at its present location, 32 Taylor Street, Springfield, Mass.

ROTH BROTHERS & COMPANY, of Chicago, Ill., expect to occupy their new factory, located at Loomis and Adams Streets, about May 1. The equipment of the old shop will be installed in the new factory. New machinery will be purchased later. The company will have about double the space of its present quarters.

THE COLUMBIA ELECTRIC HEATING & MANUFACTURING COMPANY has secured an option on a site in St. John, Ore., and is having plans drawn for a factory for the manufacture of electric irons. The company now operates a plant in Los Angeles. Peter Ottis and T. P. Faulconer are engineering the matter.

THE LIBERTY MANUFACTURING COMPANY, Pittsburgh, has issued a statement relating to rumors to the effect that, owing to internal differences, the company will go out of business. These rumors, it states,

have been circulated for the purpose of injuring its business and are denounced as without foundation and absolutely untrue.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, is erecting a new factory plant of double its present capacity. The new shops will contain all the latest labor-saving devices, and many new features regarding the general layout. It is expected that the new plant will be ready for occupancy some time in the early fall.

THE FAIRMOUNT ELECTRIC & MANUFACTURING COMPANY, Philadelphia, has purchased the patents of the "H. W. W." wire connector or test clamp, which is in extensive use by telephone companies throughout the field since 1902 and has given universal satisfaction, and has commenced its manufacture, after adding some slight improvements.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.—Mr. G. M. Sanborn, president of the National Contractors' Association, of Indianapolis, who has recently been in New York in connection with the convention of the association to be held in Toledo, Ohio, July next, is sanguine as to the success of the coming meeting, all indications pointing to the largest gatherings the contractors have held.

NEW INSULATORS FOR DYNAMO AND TRANSFORMER WINDINGS.—The Dielectric Manufacturing Company, St. Louis, is placing on the market a new insulating compound for the coils of dynamos, motors, transformers, etc., which is claimed to be a radical improvement on present compounds. The new material is called "Petrite," and is claimed to be so tough and durable as to warrant the employment of a name conveying the idea that the coil is petrified by its use.

THE ROBINS NEW CONVEYOR COMPANY has leased the entire building at 72 Front Street, New York City, and on April 1 removed its offices from 38 Wall Street to this new location. The machinery and other effects of the Duane Street factory are now being removed into the new quarters as rapidly as possible. Greatly increased facilities are provided by the new location, particularly for the manufacture of Robins laminated leather belting and Robins genuine balata belting.

ELECTRICAL EQUIPMENT OF THE NEWARK CITY HALL.—The power plant of the recently completed Newark City Hall, which is the finest public building, architecturally, in the State of New Jersey, was supplied by the Sprague Electric Company and consists of three 100-kw, 100-r.p.m., 125-volt, engine-type, direct-current generators, direct-connected to Hewes & Phillips Corliss engines. The generators furnish power for lighting service and the operation of blower motors. The ventilating system consists of blowers, belt driven by Sprague motors. Messrs. E. M. Waldron & Company were the general contractors for this building, and the electrical apparatus was selected and installed under the direction of Mr. James M. Seymour, Jr.

THE BIRD-ARCHER COMPANY, 90 West Street, New York, has secured the services of Mr. E. H. Stevens, formerly general superintendent of plants of the Public Service Corporation of New Jersey, who has resigned that position to become vice-president and general manager of the Bird-Archer Company. During his 15 years' experience in power-plant operation costs and management, Mr. Stevens has had complete charge of plants aggregating several hundred thousand horse-power, and is therefore exceptionally well prepared to deal with questions about feed-water treatment. During the past five years he has used Bird-Archer compounds exclusively in New Jersey public service plants, and is well posted on the results that can be secured by using boiler compounds. Mr. Stevens will have complete charge of sales, and will give his personal attention to inquiries from large plants which have heretofore shown serious economy losses and high operating costs on account of the scale, oil deposits and other troubles caused by bad feed-water.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 30, 1909.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

12,931. (REISSUE.) PLURAL LAMP-SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Feb. 23, 1909. A socket with a readily removable casing in which the base is provided with the lamp engaging parts, and pairs of shells are arranged one within the other, the inner shell having sockets and the outer shell openings registering with the sockets.

916,414. ADJUSTABLE INSULATED JOINT; T. H. Brady, New Britain, Conn. App. filed Feb. 21, 1908. A flexible joint so as to permit aligning the main feed pipe as it comes through the wall by providing a ball and socket connection between the bracket pipe and the main feed pipe, with adjusting screws and insulating material surrounding the main pipe and a sleeve carried by the joint.

916,418. RAILWAY SWITCH AND SIGNAL CONTROLLING AND OPERATING SYSTEM; J. T. Cado, Arcola, N. J. App. filed Aug. 8, 1908. Reduces the trouble due to crossing and grounds by providing a low potential controlling circuit with a high potential circuit for operating the switches. A device which indicates the position of the switch is actuated by an inductive impulse originating at the device operated.

916,428. WIRELESS SIGNALING; R. A. Fessenden, Washington, D. C. App. filed Nov. 17, 1905. The vessel or receptacle has a diaphragm provided with a perforation whose wall is formed of refractory material and a constant flow of liquid is forced through the perforation, thus avoiding fouling by slight particles of dirt which are carried therethrough.

916,429. RECEIVER FOR ELECTROMAGNETIC WAVES; R. A. Fessenden, Washington, D. C. App. filed July 3, 1906. A stream of liquid coming from a nozzle impinges on the diaphragm and forms the receiver.

916,435. SUPPORT FOR ELECTRIC WIRES OR CONDUCTORS; C. C. Gould, Philadelphia, Pa. App. filed March 25, 1908. The holder consists of a post with a tubular member thereon having a wall at the inner end and a sleeve of resilient coiled material which encircles the post and can be tightened.

916,436. JUNCTION BOX; E. T. Greenfield, Kiamesha, N. Y. App. filed Oct. 19, 1907. The box has a bottom portion separable from the side walls to which the wires may be secured while the bottom is separated from the sides, so that the hands of the operator are not obstructed by the sides.

916,458. TELEPHONIC RECORDING APPARATUS; R. D. Lampson, New York, N. Y. App. filed Dec. 6, 1907. Prints the fact that a call has been received over the telephone when a subscriber is absent and also prints the information giving the station from which the call is made and the time. This is done by means of a record ribbon on which the information is printed by means of a relay and a local circuit actuated by means of a magneto turned by the hand of the operator after "Central" has established the through connection.

916,459. AUTOMATIC GAS-LIGHTER; J. C. Landes, Collegeville, Pa. App. filed July 8, 1907. Improvement on prior patents in which the burner is lighted automatically by the movement of the movable parts and automatically extinguished by increased gas pressure in the mains. This is accomplished by means of a float, which opens and closes a valve.

916,462. PLURAL ARC LAMP; R. E. Leve, New York, N. Y. App. filed Aug. 17, 1908. An arc lamp with two or more negative electrodes and two or more positive electrodes together with electrical connections for connecting each negative electrode to the next positive electrode whereby all arcs may be struck at once and each electrode fed independently.

916,476. ELECTRICAL SHOT-FIRING MACHINE FOR MINES; W. B. McLarty, Wilburton, Oklahoma. App. filed Oct. 7, 1908. A magneto closes the circuits and supplies the current to different charges, at the same time giving a signal outside of the mine, so that the operator may know that the magneto is in operation.

916,483. COMBINATION WIRELESS TELEGRAPHY INSTRUMENT; J. E. Ostrander, Staatsburg, N. Y. App. filed Sept. 5, 1907. An improved coherer in which the passage of the current through the coherer operates the sounder and completely breaks all circuits passing through the coherer which produces an effective de-coherence.

916,486. BINDING-POST; H. E. Reave, New York, N. Y. App. filed Apr. 27, 1908. Especially for stranded wires in which a threaded flat post is secured to a slotted base and is provided with a perforation to receive the wires.

916,495. PROCESS AND APPARATUS FOR MAKING CALCIUM CARBID; J. S. Deymour, Whitney Point, N. Y. App. filed Oct. 4, 1905. The material is injected into the combustion chamber in powdered form commingled with combustible material and with a supporter of combustion in a blast which impinges upon the material.

916,505. RELAY; L. H. Thullen, Edgewood, Pa. App. filed March 18, 1905. The releasing point of the relay is substantially the same as the picking up point. No iron core is used and the armature is movably mounted within the core space, so that when no current passes it assumes a position that is outside of the position which it will assume when the magnet is energized.

916,537. JUNCTION BOX; C. W. Davis, Edgeworth, Pa. App. filed Oct. 15, 1908. For manholes so as to permit the addition of parts from time to time without disturbing the parts originally installed. It has a portion for busbars and a trough-shaped portion having openings for the ends of the cable.

916,538. TELEGRAPH KEY; F. Wm. De Tray, Aurora, Ill. App. filed Aug. 15, 1907. Provides a separate mechanism so that the part producing the dots cannot produce the dashes, thus reducing mistakes. A swinging lever is used with a second contact element having a pivotal mounting on the actuating lever and a stationary bearing for the second element that effects its swinging movement on the lever when said lever is operated.

916,541. VARIABLE-INDUCTANCE WINDING; M. Eastham, Boston, Mass. App. filed March 27, 1908. For wireless telegraphy to avoid breaking the circuit when the slide passes from turn to turn. Provides a plurality of wires, preferably of different lengths, connected into one side of the circuit so that the slide bridges from a turn of one wire to the corresponding turn of the other wire without breaking the circuit.

916,548. ELECTRIC FURNACE; C. W. F. Gorrell, Ottawa, Ontario, Canada. App. filed April 7, 1906. For fusing refractory materials which are non-conductors at normal temperatures, particularly for reducing sulfid ores. The electrode has a metallic body with a tip of refractory material together with means for directing a refrigerant to the body and separately directing a fluid through the tip.

916,552. SUBSTATION TELEPHONE SET; R. Hansen, Sioux City, Iowa. App. filed Dec. 9, 1907. A wall set having the usual writing shelf with a transmitter bracket pivotally adjusted on the box and a complete talking circuit wholly within and supported by the rigid part of the box.

916,575. SECONDARY BATTERY; W. Morrison, Chicago, Ill. App. filed June 8, 1903. A reversible galvanic battery having an alkaline solution, a negative pole near the bottom of the cell, zinc in contact with the positive electrode, the latter being located above the negative and insulating means therebetween so as to divide the electrolyte between the electrode. The excess of zinc is oxidized by the electrolyte without dissolving it, thus producing a current.

916,576. SECONDARY-BATTERY PLATE; Wm. Morrison, Chicago, Ill. App. filed June 29, 1903. A storage battery plate having an active material comprising oxid of lead, sulphuric acid, water, ammonia sulphate and barium sulphate.

916,659. PRODUCING METALLIC INCANDESCENT BODIES FOR ELECTRIC GLOW-LAMPS; Fritz Blau, Berlin, Germany. App. filed June 26, 1906. Makes use of a direct current instead of an alternating current to raise the crude filaments in an inert gas to a white heat, thereby avoiding irregular deformations in the film.

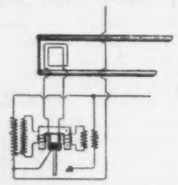
916,674. RAILWAY SIGNALING SYSTEM; C. J. Coleman, New York, N. Y. App. filed July 10, 1908. The track rails are employed for

the signal controlling circuits and the source of power is alternating. The source supplying the track is placed at the center of the block and the block limits are defined by bonds of negligible impedance. Two relays are arranged on each side of the source and one opens responsively to the opening of the other.

916,688. ELECTRICALLY OPERATED SINGLE OR VIBRATORY GONG-RINGING DEVICE; Nathan Fallek, Denver, Colo. App. filed Jan. 22, 1908. Automatically rings the gong when the car is standing still unless the motorman throws the crank handle against the stop post of the controller, and rings intermittently from the time the motorman starts the car until it has attained speed. An electrically operated bell is controlled from a crank handle working over a series of contacts.

916,717. SIGNAL LAMP; P. A. Kingston, Danville, Ill. App. filed June 26, 1908. A caboose signal lamp in which the color may be changed from the inside of the caboose and having a double casing so that the lamp will not sweat. A pivoted frame carrying the colored glass moves in front of the window and is operated from the inside of the car.

916,721. DEVICE FOR TIGHTENING OF CABLES; C. Kramer, Frankfort-on-the-Main, Germany. App. filed April 16, 1908. For transportation of coal between ship and shore in which the rolling of the ship varies the distance and in which the tension on the cable is kept the same by an automatically operating stretching motor which takes up the bight in the cable through the intermediate agency of a pulley bodily moved by the motor.



916,674.—Railway Signaling System.

916,727. TELEGRAPH KEY; R. L. Leaf, Alhambra, Ill. App. filed April 30, 1908. Does away with the shiftable bar which makes and breaks the connections and avoids the failure to close the circuit when the message has been transmitted. The circuit is automatically completed when the operator releases the button by means of an arm located over the key bar which is let go when the key is released.

916,741. ARMORED CONDUCTOR; G. A. Lutz, New York, N. Y. App. filed June 17, 1907. For flexible conduits in which a plurality of longitudinally arranged strips pass around the central axis and receive an insulated cable and a winding of flexible metal bound around the strips to hold them in position.

916,742. FLEXIBLE CONDUIT; G. A. Lutz, New York, N. Y. App. filed June 17, 1907. Like 916,741, but a binding wire is wrapped spirally around the conduit in a groove in the conduit sheath.

916,743. OUTLET OR JUNCTION BOX; G. A. Lutz, Plainfield, N. J. App. filed Feb. 12, 1908. The junction box has flanges surrounding the outlet and offset from the walls and seats and knockouts detachably secured in the seats.

916,776. ELECTRIC HAND-LIGHTING GAS-BURNER; A. J. Perkins, Revere, Mass. App. filed Oct. 21, 1908. A "pull down" gas burner which turns on the gas and moves a spring electrode in contact with the burner tip electrode. The movable electrode pin is done away with and a spiral spring with a projecting end carried by the lever forms the movable electrode.

916,792. TRANSFORMER; H. F. Selinger, St. Louis, Mo. App. filed May 21, 1908. For use with small-sized transformers for switchboard instruments. Induces internal losses by winding the wire directly on the core instead of on a form.

916,793. PRODUCTION OF SILICON; G. O. Seward, East Orange, N. J., and F. Von Kugelgen, of Holcombs Rock, Virginia. App. filed May 14, 1907. Produces silicon by subjecting a silicon compound and a reducing agent to sufficient heat to volatilize it, at the same time maintaining above the zone of reduction a cooler zone containing a non-oxidizing atmosphere in which the volatilized silicon is condensed.

916,812. INCANDESCENT ELECTRIC LAMP SOCKET; A. Weber, Sr., and John Weber, Schenectady, N. Y. App. filed July 18, 1904. Consists of a pair of interlocking, tubular sheet metal members, one adapted to telescopically receive the other, with mutually abutting cut metal edges to prevent separation when interlocked and other means for preventing a relative movement of the interlocked members.

916,829. LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed July 14, 1904. Insulating means for lamp sackets. The socket is also provided with a readily separable locking connection between the supporting plate and casing.

916,833. POCKET ELECTRIC INCANDESCENT LAMP; Fritz Blau, Berlin, Germany. App. filed April 28, 1906. A dry battery energizes the lamp and the battery is movable within the lamp so that by raising the battery by pushing the finger through an opening in the base of the container, the circuit is made.

916,840. RELAY; S. Cabot, Brookline, Mass. App. filed Nov. 20, 1906. A relay operated by wireless telegraph currents in which an electrolytic sensitive detector is used which receives the incoming waves and through the supplementary action of the condenser produces a discharge across a fusible contact member attached to a diaphragm, thus reducing the resistance of the contact and allowing a local battery current to flow which gives the relay current.

916,843. CONTROLLER; H. W. Cheney, Norwood, O. App. filed Nov. 1, 1907. Potential starters for induction motors in which the controller is prevented from moving backward from a running to a starting position. The controller is biased backward to off position when in any starting position and biased forward to off position when in running position.

916,844. ELECTRICAL CONNECTING DEVICE; E. A. Colby, Newark, N. J. App. filed Dec. 14, 1905. For sealing electric conductors in glass walls where currents of strength exceeding 5 or 6 amp are used. Makes use of a thimble of platinum, the glass being molded around the thimble and the thimble is reduced in thickness at the open end, which receives the connecting wire whereby the rate of radiation of metal and glass is inconsiderable in effect.

916,863. OVERHEAD ELECTRICAL CAR SYSTEM; G. Heineman, San Francisco, Cal. App. filed Sept. 13, 1907. Supplies the electric cars with current by means of a supply cable and a series of distributing wires connected to depending contacts which are actuated by the trolley brush of the cars.

916,866. METHOD OF TREATING ALUMINOUS MATERIALS AND PRODUCTS THEREOF; A. C. Higgins, Worcester, Mass. App. filed March 20, 1906. Makes an abrasive by fusing an aluminous material and cooling or chilling the product.

916,877. ELECTRODE FOR ARC LAMPS; F. Kalkner, Nuremberg, Germany. App. filed Aug. 11, 1908. Arc lamps for projecting lanterns in which the negative carbon is smaller than the positive carbon and has a thick metallic casing surrounding it to reduce the heating by the current passing through it.

916,879. VAPOR ELECTRIC CONDUCTOR; O. Kruh, Schenectady, N. Y. App. filed July 11, 1903. For rectifying alternating current. Employs a plurality of anodes and a single cathode, together with a single starting electrode located adjacent to the cathode and receiving current from the alternating means.

916,882. RAIL-BOND; A. Light, Spadra, Ark. App. filed Sept. 17, 1908. A rail-bond provided with sleeves which surround the bolts that connect the rail and fish plates. It is made in one piece and consists of a neck with a hollow sleeve at each end.

916,895. SPACE TELEGRAPHY; John S. Stone, Cambridge, Mass. App. filed Dec. 14, 1905. Avoids interference, particularly "static" interference, even in cases where the condenser is serially included in the elevated conductor by providing protecting means across the condenser which has an impedance so much greater than that of the condenser that it operates as an open circuit.

916,896. RAILWAY SIGNALING; S. D. Strohm, Philadelphia, Pa. App. filed Aug. 29, 1891. For controlling the engines of railways and avoiding the danger of collision by providing the engine or motor car with a circuit including an electromagnet which is controlled to shut off the power by means of the movement of a semaphore arranged along the track.

916,898. MOTOR-CONTROL SYSTEM; E. W. Stull, Norwood, O. App. filed Dec. 31, 1906. A motor-control system making use of a plurality of switches in series with means for closing them simultaneously and opening them consecutively so as to localize the arcing at one switch.

916,900. PROCESS FOR ELECTROLYTICALLY PRODUCING PEROXID OF HYDROGEN; G. Teichner, Nuremberg, Germany. Forms peroxid of hydrogen from persulfuric acid and separates the peroxid from the sulfuric acid produced.

916,905. CARBON, FILAMENT, AND METHOD OF MAKING THE SAME; W. R. Whitney, Glenville, N. Y. App. filed Feb. 2, 1905. A new form of graphite having a metallic temperature-resistance characteristic, which has a higher resistance when hot, the method of making it being to heat ordinary carbon filament to a high temperature, to drive out impurities, then flashing and then firing to a degree sufficiently to permanently change the resistance characteristic.

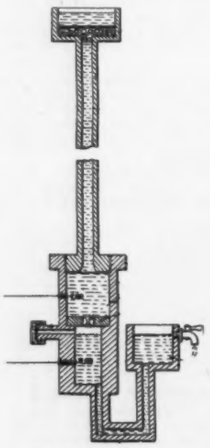
916,909. PLURAL LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Aug. 25, 1906. A plural lamp socket having a casing, a group of sockets carried by the casing and a central socket with means for connecting one of the contacts of the central socket with one contact of all the other sockets and means for connecting the opposite sockets, the other central socket being insulated.

916,918. ELECTRICAL CIRCUIT BREAKING AND MAKING DEVICE FOR TELEGRAPHIC PURPOSES; C. Edward Davies, Ottawa, Ontario, Can. App. filed Nov. 27, 1907. A repeater making use of two instruments, each of which includes an electromagnet, a pivoted armature and a spring for retracting the armature. Details.

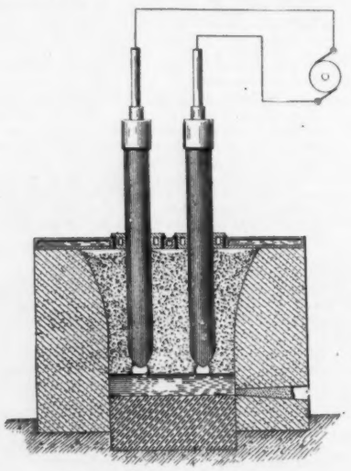
916,928. DYNAMO-ELECTRIC MACHINE; D. Hall, Norwood, O. App. filed Jan. 31, 1906. Dynamo-electric machines having auxiliary or commutating field poles intermediate the main field poles for reducing the sparking at the brushes, the inner portion of the auxiliary poles being adjustable so as to vary the length of the poles.

916,931. CONNECTIVE DEVICE FOR ELECTRICAL CONDUITS AND THE LIKE; A. McMurtrie, New York, N. Y. App. filed Dec. 13, 1907. For use at the ends of armor tubes; avoids the screw threads on the sheaths by coupling through a flange on the armored tube and a nut on the end of the tube.

916,932. HOODED CONNECTOR FOR ELECTRICAL CONDUITS AND THE LIKE; A. McMurtrie, New York, N. Y. App. filed Dec. 13, 1907. See 916,931. The housing has a sheath and is provided with an attaching portion angularly disposed with relation to the sheath receiving portion.



916,428.—Signaling.



916,793.—Production of Silicon.

916,937. CONDUIT COUPLING; R. McKean Thomas, Elizabeth, N. J. App. filed May 22, 1908. Makes use of a stove bolt coupler for connecting the armored cable to the junction box.

916,938. ELECTRICAL BOX COUPLING; R. McKean Thomas, Elizabeth, N. J. App. filed May 22, 1908. Makes use of a stove bolt connector for connecting the cable to the junction box.

916,950. TRANSMITTER; R. Hansen, Muskegon, Mich. App. filed May 1, 1907. Means for adjusting the carbon cell in the bridge by slotting the bridge and providing binding posts mounted in and through enlarged ends of the slot.

916,958. ELECTRICAL CIRCUIT CONTROLLER; H. W. Eichbaum, Venice, Cal. App. filed June 8, 1908. Particularly for operating switch-throwing and gate-moving means in which the switch is moved by an electric motor and is held in locked position by a bolt operated by an electromagnet.